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VOLUME IV

EG&G
ROCKY FLATS

PHASE I RFI/RI WORK PLAN FOR OPERABLE UNIT 5
Woman Creek Priority Drainage

Rocky Flats Environmental Restoration Project

VOLUME IV - Text to Technical Memorandum No. 15 - Amended Field Sampling Plan (Vol. II - Text)

AUGUST 1994

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TABLE OF CONTENTS

ROCKY FLATS PLANT FINAL PHASE I RFI/RI WORK PLAN WOMAN CREEK PRIORITY DRAINAGE OPERABLE UNIT 5

VOLUME I

DOCUMENT CLASSIFICATION REVIEW WAIVER
PER R.B. HOFFMAN, CLASSIFICATION OFFICE
JUNE 11, 1991

VOLUME II

FINAL
TECHNICAL MEMORANDUM No. 15

ADDENDUM TO FINAL PHASE I
RFI/RI WORK PLAN

Amended Field Sampling Plan
Volume 2

Rocky Flats Plant
Woman Creek Priority Drainage

(Operable Unit No. 5)

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Prepared for:

U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant Golden, Colorado

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LIST OF APPENDICES

Appendix

LIST OF TABLES

Table No.

LIST OF FIGURES

Figure No.

LIST OF ACRONYMS

μg/kg	micrograms per kilogram
μg/L	micrograms per liter
μS/cm	microSiemens per centimeter
1,1,1-TCA	1,1,1-trichloroethane
ACGIH	American Conference of Governmental Industrial Hygienists
ACM	asbestos-containing material
BAT®	Bengt-Arne Tortensson
BUTL	Background Upper Tolerance Limit
CCTV	closed-circuit television
CDH	Colorado Department of Health
C_i	particulate concentrate
CMP	corrugated metal pipe
COC	chain of custody
cpm	counts per minute
CPT	cone penetrometer testing
CSU	Colorado State University
CV	coefficient of variation
CWA	Clean Water Act
DCN	Document Change Notice
DCM	dichloromethane
DMR	Document Modification Request
DO	dissolved oxygen
DOE	U.S. Department of Energy
dpm/100cm^2	disintegrations per minute per 100 square centimeters
EC_{50}	effective concentration 50 percent results
EM	electromagnetic
EM/SWD	Environmental Management/Surface Water Division
EMAT	Environmental Monitoring and Assessment Technologies
EPA	U.S. Environmental Protection Agency
FFCA	Federal Facility Compliance Agreement
FIDLER	Field Instrument for the Detection of Low Energy Radiation
FSP	Field Sampling Plan
ft	feet
ft^2	square feet
ft^3/m	cubic feet per minute
g	gram

gpm	gallons per minute
GRRASP	General Radiochemistry and Routine Analytical Services Protocol
GSCS	Geophysical Survey Control Station
H&S	health and safety
HPGe	high purity germanium
IAG	Interagency Agreement
IHSS	Individual Hazardous Substance Site
IHSS 115	Original Landfill
IHSS 133.1	Ash Pit 1
IHSS 133.2	Ash Pit 2
IHSS 133.3	Ash Pit 3
IHSS 133.4	Ash Pit 4
IHSS 133.5	Incinerator
IHSS 133.6	Concrete Wash Pad
IHSS 142.10	Pond C-1
IHSS 142.11	Pond C-2
IHSS 196	Water Treatment Plant Backwash Pond
IHSS 209	Surface Disturbances
kg	kilogram
L/s	liters per second
LC_{50}	lethal concentration 50 percent results
lf	linear feet
m	meter
mg/L	milligrams per liter
mg/kg	milligrams per kilogram
mm	millimeter
mmhos/m	millimhos per meter
mS/cm	milliSiemens per centimeter
nCi/g	nanocuries per gram
n.d.	no date
NPDES	National Pollutant Discharge Elimination System
OU	Operable Unit
OU5	Operable Unit No. 5
OVM	organic vapor meter
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
pCi/L	picocuries per liter

pCi/g	picocuries per gram
PM_{10}	inhalable particulate matter
ppm	parts per million
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
RAAMP	Radioactive Ambient Air Monitoring Program
RCA	radiologically controlled area
RCP	reinforced concrete pipe
RCRA	Resource Conservation and Recovery Act
RFEDS	Rocky Flats Environmental Data System
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RFP	Rocky Flats Plant
s	seconds
SED	sediment
SID	South Interceptor Ditch
SOP	standard operating procedure
SVOC	semi-volatile organic compound
SW	surface water
SWTMP	Surface Water Toxicity Monitoring Program
TAL	target analyte list
TCE	trichloroethene
TCL	toxic compound list
TDEM	time domain electromagnetic
TIC	tentatively identified compound
TM	Technical Memorandum
TOC	total organic carbon
USCS	Unified Soil Classification System
UU	undrained unconsolidated
VCR	video cassette recorder
VOC	volatile organic compound
WET	whole effluent toxicity

1.0 INTRODUCTION

This Technical Memorandum (TM) presents the results obtained during implementation of the Work Plan for the Phase I RCRA Facility Investigation/Remedial Investigation (RFI/RI) of the Woman Creek Drainage (Operable Unit No. 5 (OU5)) at the Rocky Flats Plant (RFP), Jefferson County, Colorado (DOE, 1992a). This TM also identifies gaps in the data obtained thus far in the investigation and proposes an amended Phase I Field Sampling Plan (FSP) for obtaining the information necessary to fill those gaps.

This TM is presented in two volumes. Volume 1 provides a summary of the data obtained by the Phase I RFI/RI to date and then provides a proposed amended FSP for obtaining necessary additional information. This volume, Volume 2, presents a detailed discussion of the Phase I RFI/RI activities conducted to date. This volume outlines the methodology for and results of each stage of the investigation and provides the bases for the identification of data gaps and the development of the amended FSP as presented in Volume 1.

1.1 PURPOSE OF PROJECT

The purpose of the OU5 Phase I RFI/RI is to assess the potential contamination associated with several Individual Hazardous Substance Sites (IHSSs) that are located within the Woman Creek drainage. The data collected under the field investigation portion of the RFI/RI will be used to begin developing and screening remedial alternatives and to evaluate the need for further studies of the OU5 IHSSs. The data will also be used to estimate risks to human health and the environment posed by each IHSS.

This TM has two primary objectives. The first is to use the currently available results to describe the activities that have been performed under the Phase I RFI/RI. The second objective is to identify where additional data are required to assess the nature and extent of contamination at the IHSSs and provide an amended Phase I FSP for obtaining these data.

1.2 BACKGROUND

Eleven IHSSs, geographically located along or within the drainage areas of Woman Creek (Figure 1.2-1), have been designated as OU5. These IHSSs include the Original Landfill (IHSS 115); Ash Pits, Incinerator, and Concrete Wash Pad (IHSSs 133.1 through 133.6); Detention Ponds C-1 and C-2 (IHSSs 142.10 and 142.11); and a Surface Disturbance (IHSS 209). Ponds C-1 and C-2 are the only IHSSs located on Woman Creek. The remaining IHSSs are located along the banks and/or upland areas that drain into Woman Creek or into the South Interceptor Ditch (SID). In addition to these IHSSs, two additional surface disturbances are being investigated in the Phase I OU5 investigation, a Surface Disturbance West of IHSS 209 and a Surface Disturbance South of the Ash Pits.

On May 27, 1993, the U.S. Environmental Protection Agency (EPA) and the Colorado Department of Health (CDH) notified the U.S. Department of Energy (DOE) that IHSS 196, Water Treatment Plant Filter Backwash Pond, was to be included in the OU5 investigation. This IHSS was previously scheduled to be investigated as part of OU16, Low Priority Sites. Because of its proximity to IHSS 115, the investigation of IHSS 196 was conducted concurrently with that of IHSS 115.

1.2.1 IHSS Descriptions and Histories

The following sections describe the locations, physical features, and histories of each of the OU5 IHSSs. These discussions are primarily based on the information provided in the OU5 Work Plan. Sections 2.4 to 2.7 of this TM discuss additional information that was obtained during the course of the investigation of the IHSSs that provide further detail regarding the location, description, and history of the IHSSs.

1.2.1.1 IHSS 115 (Original Landfill) and IHSS 196 (Filter Backwash Pond)

The Original Landfill is located within the buffer zone just south of the RFP industrialized area and south of the west access road (Figure 1.2-2). It is located north of Woman Creek on a moderately to steeply sloping south-facing hillside.

The Original Landfill was in operation from 1952 to 1968 and was used to dispose of general wastes generated at RFP. It is estimated that 2 million cubic feet of miscellaneous RFP wastes are buried in the landfill, including such things as solvents, paints, paint thinners, oil, pesticides, and cleaners (Rockwell, 1988). These wastes were not considered hazardous prior to 1968, when they were placed in the landfill. The landfill also received beryllium and/or uranium wastes and may originally have been used as a graphite dump. It has been reported that ash containing an estimated 20 kilograms (kg) of depleted uranium (DOE, 1986), produced when 60 kg of depleted uranium were inadvertently burned and only 40 kg were recovered, was buried within the landfill. Chemicals that may have been placed in this landfill include commonly used solvents, such as trichloroethene (TCE), carbon tetrachloride, tetrachloroethene (PCE), petroleum distillates, 1,1,1-trichloroethane (1,1,1-TCA), dichloromethane (DCM), benzene, paint and paint thinners. Metals such as beryllium, uranium, lead, and chromium may also be present (Rockwell, 1988). Accurate records of any further wastes placed in this landfill are not available.

IHSS 196, an evaporation/settling pond that was used for backflushing sand filters from the water treatment facility (Building 124), was located near the western edge of the landfill (Figure 1.2-2). It appears that a second pond was visible in a 1955 aerial photograph in the approximate location of the SID, but by 1964 this pond was no longer present and the area had been covered by fill (DOE, 1992a).

By 1980, the SID had been built across the southern part of the landfill. Several other activities at the landfill are apparent from aerial photographs of the area presented in EPA (1988). A surface disturbance area east of the landfill was active in a 1964 aerial photograph. Little documented historical information is available concerning this area; however, this area may have served as a storage yard for pipes and scrap metal. In addition, soil appears to have been placed in this area as substantial mounds of debris are noted in this area in 1969 and 1971 aerial photographs (EPA, 1988).

The landfill was closed with a soil cover; however, a bottom liner was not installed. Details of the construction of the surface cover are not available, nor is the year the cover was installed. The slope on the south side of the landfill was regraded to correct sloughing and erosion-related problems.

Two storm-sewer pipes protrude from the landfill area (Figure 1.2-2). The west pipe is no longer connected to a drainage system. The pipe which cuts diagonally across the landfill from west to east appears to be connected to storm drains and possibly foundation drains in the 400

Area (Section 2.4.5). This pipe discharges to the SID just east of the surface disturbance east of the landfill.

1.2.1.2 IHSS 133 (Ash Pits, Incinerator, and Concrete Wash Pad)

The Incinerator, Ash Pits, and Concrete Wash Pad are located south-southwest of the industrialized area of RFP, south of the west access road and north of Woman Creek (Figure 1.2-3). The locations of these IHSSs are defined from historic aerial photographs. The Incinerator, which had a 10- to 20-foot stack, was located along RFP's original west boundary, off the west access road. The Ash Pits are located to the east, and Concrete Wash Pad is located southwest of the Incinerator. Ash Pits 1, 2, 3, and 4 (IHSSs 133.1, 133.2, 133.3, 133.4) are approximately 8 feet (ft) wide by 150 ft long and 3 ft deep. However, these Ash Pits may be larger as the exact boundaries and dimensions of each unit are somewhat undefined (DOE, 1987). The four Ash Pits are located on a relatively flat surface and are currently covered by tall grasses.

The Incinerator area (IHSS 133.5) occupies approximately 4,000 square feet (ft^2) and the Concrete Wash Pad (IHSS 133.6) covers an area of about 33,000 ft^2. These two IHSSs are located west of the four Ash Pits. The area surrounding the Concrete Wash Pad has an extremely irregular hummocky surface that slopes gently to the south toward Woman Creek.

The Incinerator was used to burn general RFP wastes between the 1950s and 1968. Depleted uranium is also believed to have been burned in the Incinerator (Rockwell, 1988). A review of aerial photographs revealed that the Incinerator was removed by 1971 and the entire area was beginning to revegetate (EPA, 1988). Ashes from the Incinerator were placed into the Ash Pits or were pushed over the side of the hill into the Woman Creek drainage and/or onto the

Concrete Wash Pad (Rockwell, 1988). Following the shutdown of the Incinerator after 1968, the Ash Pits were covered with fill (Rockwell, 1988); however, information about the material used in the construction of the cover is unavailable.

The history of the Concrete Wash Pad has not been as well documented as the Ash Pits or Incinerator area. It appears that this area was used to dispose of waste concrete from the concrete trucks involved in the construction activities of RFP. It is also likely that the concrete trucks were washed down in this area after delivering concrete.

The history of the Ash Pits, Incinerator, and Concrete Wash Pad is not entirely known because few records were kept of their operations. It is, known, however, that general combustible wastes from RFP were burned in the Incinerator along with an estimated 100 grams of depleted uranium (Owen and Steward, 1973). The ashes from the Incinerator were disposed in the Ash Pits. At the Concrete Wash Pad, potentially contaminated materials consist of concrete debris and occasional ashes from the Incinerator that were reported to have been pushed over the side of the hill onto the Concrete Wash Pad area (Rockwell, 1988).

A rayscope survey (an unknown type of survey) was conducted over Ash Pit 3 (IHSS 133.3) prior to 1973 and the results of this survey detected metals (type unknown) (DOE, 1987). No documentation exists as to whether the other Ash Pits (IHSSs 133.1, 133.2, and 133.4) had a rayscope survey done over their surfaces.

1.2.1.3 IHSS 142.10 and 142.11 (C Ponds)

Ponds C-1 (IHSS 142.10) and C-2 (IHSS 142.11) are located along Woman Creek, southeast of the industrialized area of RFP and within the Buffer Zone (Figure 1.2-1). These ponds are approximately 2,000 ft apart, with Pond C-1 to the west of Pond C-2. The estimated capacities for Ponds C-1 and C-2 are approximately 750,000 gallons and 2,480,000 gallons, respectively.

The natural drainage of Woman Creek has been somewhat modified in the OU5 area by the construction of Ponds C-1 and C-2 and the SID south of RFP. Currently, Woman Creek flows eastward through OU5 in its natural stream channel to Pond C-1 (Figure 1.2-1). Filter backwash water from the water treatment facility was discharged in Pond C-1 between RFP start-up in 1952 and December 21, 1973 (DOE, 1980). In addition, the cooling tower blowdown water was discharged to Pond C-1 until the latter part of 1974. In the early 1970s, RFP operations were changed and Pond C-1 was used principally to manage the surface water runoff in the Woman Creek drainage. Water is rarely retained within this pond as the outlet or gate is usually open and the water is allowed to flow through the pond. The water consequently flows in its natural channel until just west of Pond C-2 where it is diverted around Pond C-2 by a diversion canal. During low flows, downgradient and to the east of Pond C-2, all of the water is diverted from Woman Creek's main channel into an unnamed ditch that flows into Mower Reservoir. During high flows, some flow continues to flow downstream in Woman Creek and into Standley Lake Reservoir.

In 1980, the SID was constructed upslope (to the north) of Woman Creek (Figure 1.2-1) to intercept surface runoff from RFP. A berm was constructed on the downslope side of the SID to contain the water flowing in this ditch. Since construction of the SID in 1980, Woman Creek has not received runoff directly from the southern part of RFP. Surface water flow in the SID is intermittent and usually occurs only following precipitation events or snow melt. When flow is low, water tends to pond in several areas of the ditch. The SID begins approximately 200 ft east of the Ash Pits and runs for almost two miles to Pond C-2 (Figure 1.2-1). The SID is approximately 4 to 8 ft in depth and is not lined. Just upslope of Pond C-2, the water flowing in the SID crosses over Woman Creek and flows into Pond C-2. In Pond C-2, the water is sampled, analyzed, and discharged into a canal that diverts water around Great Western Reservoir according to a National Pollutant Discharge Elimination System (NPDES) agreement (Permit No. CO-0001333).

1.2.1.4 IHSS 209 and Other Surface Disturbances

Three separate surface disturbances will be described in this section: IHSS 209, the Surface Disturbance West of IHSS 209, and the Surface Disturbance South of the Ash Pits. IHSS 209 is located to the southeast of the RFP industrialized area, south of Woman Creek and approximately 1,000 ft southeast of Pond C-1 (IHSS 142.10) (Figure 1.2-4). This area was included as an IHSS because unknown activities took place in this area of shallow excavations and surface disturbances (DOE, 1992a). IHSS 209 covers approximately 225,000 ft^2 (5.2 acres) and is located on a long narrow plateau bounded to the north, east and south by a slope leading into the Woman Creek drainage. A dirt road transects this IHSS and loops near the eastern boundary. Three excavations are located within the boundary of this IHSS (Figure 1.2-4). Two depressions, which periodically retain water, are present near the northern and southwestern boundary of the IHSS (Figure 1.2-4).

A second surface disturbance, the Surface Disturbance West of IHSS 209, located approximately 1,500 ft west of IHSS 209 is also included in the OU5 investigation. The area consists of several small disturbed areas in a somewhat symmetric arrangement (Figure 1.2-4). This disturbance covers an area of approximately 62,500 ft^2 (approximately 1.4 acres).

A third surface disturbance area, the Surface Disturbance South of the Ash Pits, is also being investigated under the OU5 RFI/RI. This area is located 1,200 ft south of IHSS 133 and south of Woman Creek. This area consists of several former excavation areas (Figure 1.2-5). These surface disturbances were identified in aerial photographs taken between 1955 and 1988 as presented in EPA (1988). There is still surface evidence of some of these disturbances. Two former excavations trend along northeast-southwest axes (Figure 1.2-5). Each excavation is approximately 30 ft wide by 400 ft long. A third area is located northeast of the parallel excavations and a fourth excavation (3 ft wide by approximately 2 ft deep) is located to the southwest. This excavation trends in a north-south direction across the plateau. An additional disturbed area is approximately 150 ft wide by 600 ft long and is located upslope (southwest) from the other disturbances.

It is not known what activity or activities may have taken place at IHSS 209 or at the other surface disturbances. However, the time period in which these areas were disturbed has been estimated from aerial photographs presented in EPA (1988).

IHSS 209 first appears as a disturbed area in a 1955 aerial photograph (EPA, 1988). The ground was disturbed both west and east of the dirt road; however, no obvious features or equipment can be seen in the photo. By 1961, three excavations existed within this IHSS. The depression located near the southwestern boundary of this IHSS appears as a pond in 1980, 1983, and 1988 aerial photographs (EPA, 1988). A 1980 aerial photograph also reveals that the western half of the IHSS was beginning to revegetate. By 1988, the only recognizable features on or near this surface disturbance were the presence of the eastern-most excavation and the pond located near the northern boundary of this IHSS (Figure 1.2-4).

The OU5 Work Plan stated that the Surface Disturbance West of IHSS 209 appears to have been the location of a radio tower installation based on the geometry of the five disturbances at this site. This surface disturbance was observed in a 1955 aerial photograph and was still evident on photographs until about 1971 when the area started revegetating. A radio tower, however, was never viewed in the aerial photographs.

The east excavation area was the first area to be noted as active in the Surface Disturbance South of the Ash Pits. This was observed in a 1955 aerial photograph. The two parallel excavations became active prior to 1978, as they are visible in a 1978 photo (EPA, 1988). After 1983, the excavation areas started to revegetate. The west area, located approximately 400 ft southwest of the parallel excavations, became active prior to 1969 (EPA, 1988) and is now backfilled with large rocks. It is not known when these rocks were placed.

2.0 PHASE I FIELD INVESTIGATION

This section discusses the rationale for the selection and design of the various field investigations conducted during the Phase I RFI/RI, the implementation of these activities, and their results. Prior to discussing the investigation of each OU5 IHSS, the Phase I RFI/RI Work Plan and associated technical memoranda (TMs), and field investigation and data evaluation procedures are briefly described. The field investigations at OU5 discussed in this TM commenced in June 1992 and, with the exception of the ongoing groundwater monitoring and an additional geophysical survey (see Section 2.5.2.2), were completed in August 1993.

2.1 SUMMARY OF PHASE I RFI/RI WORK PLAN AND TECHNICAL MEMORANDA

The Phase I RFI/RI Work Plan for OU5 presents an FSP that defines a staged approach to investigating each IHSS. The Work Plan outlines the use of an "Observational Approach" to achieve the objectives of the RFI/RI. This technique provides for continually reassessing site conditions as data are obtained. Sampling plans for subsequent stages of investigation are formulated to build on existing information. These sampling plans are submitted as TMs to EPA and CDH for review prior to implementation. The OU5 Work Plan identified nine TMs to be prepared to outline sampling plans for investigations of IHSS 115 and the IHSS 133 group. A total of ten TMs were prepared during the implementation of the Phase I FSP at OU5. The following paragraphs summarize the FSP outlined by the OU5 Work Plan and by each of the ten TMs.

The OU5 Work Plan identified site-specific data needs based on preliminary identification of contaminants potentially present at each IHSS and the data needs for the Phase I Baseline Risk

Assessment and Environmental Evaluation. The FSP presented in the OU5 Work Plan was based on these data needs and the requirements of the Interagency Agreement (IAG) between DOE, EPA, and CDH. The FSP for each IHSS required a combination of screening activities; sampling of soils, sediments, and surface water; and well installation and sampling. Table 2.1-1 is a matrix showing the IAG-required tasks and how these tasks were implemented as defined in the OU5 Work Plan, as amended by the TMs.

Stage 1 activities at each IHSS consisted primarily of the review of existing data, such as the results of previous investigations, aerial photographs, and other historical documents. Stage 2 activities were screening activities that included radiological, geophysical, and soil gas surveys. Sampling of surface and subsurface soils were the predominant Stage 3 activities, and Stage 4 activities were primarily associated with groundwater investigations. If other activities were to be performed that did not fall into Stages 1 to 4, these activities were conducted under Stage 5. The site-specific FSPs outlined in the OU5 Work Plan are briefly summarized below.

<u>IHSS 115 (Original Landfill) and IHSS 196 (Filter Backwash Pond)</u>. Review and screening activities specified for the Original Landfill, including the area of IHSS 196, consisted of a review of a gamma radiation survey completed in 1990, review of aerial photographs, and completion of a soil gas survey and geophysical surveys. Sampling identified included surface soil sampling, subsurface sampling in borings, and sediment and surface water sampling adjacent to the units. The OU5 Work Plan also specified that cone penetrometer testing (CPT) and Bengt-Arne Tortensson (BAT®) sampling be performed, and wells be installed and sampled downgradient of the IHSS and in selected soil borings, if plumes were encountered. Additionally, pipes protruding from the landfill were to be investigated and, if present, effluent sampled. The OU5 Work Plan specified that TMs be prepared to present site-specific FSPs for

the soil gas survey, geophysical surveys, surface soil sampling, CPT, and monitoring well installation and sampling.

<u>IHSS 133.1-6 (Ash Pits 1-4, Incinerator, and Concrete Wash Pad)</u>. Tasks specified by the FSP for the IHSS 133 sites included a review of aerial photographs and radiological and geophysical surveys to identify the extent of these IHSS sites. Sampling activities specified included surface soil sampling, subsurface soil sampling in borings, and installation and sampling of wells. The preparation of TMs was specified for the geophysical surveys, surface soil sampling, subsurface soil sampling, and monitoring well installation and sampling.

<u>IHSS 142 (C Ponds)</u>. Activities specified by the FSP for IHSS 142.10 (C-1 Pond) and IHSS 142.11 (C-2 Pond) included a review of existing data collected by ongoing monitoring activities to assess potential overlap between the ongoing programs and the proposed OU5-specific program. Contingent upon the results of the review of ongoing monitoring programs, the FSP also specified that surface water and sediment samples be collected from the ponds, Woman Creek, and the SID. In addition, monitoring wells were to be installed and sampled downgradient of each pond.

<u>IHSS 209 (Surface Disturbance Southeast of Building 881), the Surface Disturbance West of IHSS 209, and the Surface Disturbance South of the Ash Pits</u>. Screening activities to be conducted at these sites included reviews of historical use information pertaining to these sites, visual inspections, and radiological surveys. Sampling activities specified by the FSP included surface soil sampling from the excavations present at each site, subsurface sampling from borings, and collection of sediment and/or surface water samples from each of the former pond areas at IHSS 209.

The FSP defined in the OU5 Work Plan was amended by ten TMs at various stages during the field investigation. As is discussed in detail below, the scope of each TM does not agree in all cases with that described in the Work Plan. Because some of the activities to be described in the TMs specified by the Work Plan were similar, a single TM to address the same activity at more than one IHSS was prepared rather than preparing individual TMs for each IHSS. In addition, during the course of investigating each IHSS, it became apparent that the scope of subsequent Work Plan activities was not appropriate or adequate, thus necessitating the preparation of additional TMs. Similarly, the scope of several field investigation activities was clarified in letters submitted to EPA and CDH prior to implementing these activities. These letters were prepared for activities where the Work Plan did not require a TM, but additional definition or clarification of the scope of the activity was necessary. Copies of these letters are included in Appendix A. The scope of each TM and letter prepared during the implementation of the Phase I RFI/RI is summarized below. In addition, each TM is discussed in detail in Sections 2.4 to 2.7.

<u>TM1 - Revised Network Design - Field Sampling Plan (EG&G, 1993a)</u>. TM1 documented the results of the review and assessment of ongoing surface water and sediment monitoring programs discussed under IHSS 142 above. Based upon this assessment of the ongoing programs, this TM provided an amended FSP for the collection and analysis of surface water and sediment samples from the C-1 and C-2 Ponds, Woman Creek and its tributaries, and the SID. In addition to addressing sampling activities for the ponds, this TM also addressed surface water and sediment sampling activities for all other OU5 IHSSs. This TM also specified the installation of shallow well points along Woman Creek to augment ongoing groundwater/surface-water interaction studies. The sampling and monitoring programs defined by this TM are discussed in detail in Section 2.6.2.

<u>TM2 - Surface Geophysical Surveys (EG&G, 1992a)</u>. TM2 described the approach for performing magnetic and electromagnetic (EM) surveys at IHSS 115 and the IHSS 133 sites. Due to similarities in these surveys at both IHSSs, one TM was prepared to describe these surveys rather than the two TMs identified in the Work Plan. This TM documented the results of the review of the 1990 radiological survey of IHSS 115 and reviews of existing information,

including aerial photographs, for both IHSS 115 and the IHSS 133 sites. It also provided the details of the procedures to be followed for performing geophysical surveys at both IHSSs. The methodology for and results of these surveys are discussed in detail in Sections 2.4.2.1 and 2.5.2.2.

<u>TM3 - Surface Soil Sampling Plan - Original Landfill (EG&G, 1993b)</u>. TM3 presented the sampling and analytical program for surface soils within IHSS 115. The sampling and analytical program defined in this TM consisted of collection of samples for analysis of radionuclides from anomalies identified by the 1990 radiological survey of IHSS 115 and collection of samples for analyses of chemicals and radionuclides from the disturbed area east of the landfill and from landfill cover material. The surface soil sampling program is discussed in detail in Section 2.4.3.1.

<u>TM4 - Surface Soil Sampling Plan - Ash Pits, Incinerator, and Concrete Wash Pad (EG&G, 1993c)</u>. TM4 specified the sampling and analytical program for surface soils within the IHSS 133 sites. Similar to the program defined by TM3 for IHSS 115, the program defined by this TM included sample collection for analysis of radionuclides from anomalies identified by a radiological survey of these sites conducted as part of the OU5 RFI/RI (see Section 2.5.2). It also involved sample collections for analyses of chemicals and radionuclides from areas believed to have been impacted by disposal operations at the IHSS 133 sites. Section 2.5.3.1 discusses the methodology and results of this sampling program.

<u>TM5 - Revised Soil Gas Sampling Plan - Original Landfill (EG&G, 1993d)</u>. Based on the results of other soil gas surveys conducted at RFP and on the review of historical data and other screening activities at IHSS 115, it was determined that modification of the soil gas sampling plan proposed in the OU5 Work Plan was necessary. TM5 presented the results of the previous investigations at IHSS 115 and provided a revised sampling and analysis plan for the soil gas survey. The results of this survey are discussed in Section 2.4.3.3.

<u>TM6 - Cone Penetrometer Testing and Groundwater Sampling Plan - IHSS 115 (EG&G, 1993e)</u>. The OU5 Work Plan proposed the performance of CPT and collection of groundwater samples with a BAT® (or equivalent) sampling device. The Work Plan specified that a TM be prepared that would define the specific procedures and locations for these activities. TM6 specified the procedures and locations for CPT and provided a methodology for selecting locations for collection of groundwater samples contingent upon the results of the CPT and other previous and ongoing investigations at IHSS 115. Due to several advantages of this technique, this TM also specified the collection of groundwater samples from well points rather than with the BAT®

sampling device. The implementation and results of these activities are described in detail in Sections 2.4.4.1 and 2.4.4.2.

TM7 - Soil Boring Sampling Plan - Ash Pits 1-4, Incinerator, and Concrete Wash Pad (EG&G, 1993f). Soil borings to be drilled in the areas of the IHSS 133 sites were proposed by the OU5 Work Plan. The Work Plan also specified that a TM be prepared to better define the locations of these borings based on the results of preceding investigations. TM7 provided an FSP for the drilling and sampling of borings at the IHSS 133 sites. It also specified the collection of groundwater samples from within borings using the Hydropunch II or BAT® samplers where groundwater was present. The soil boring program and its results are discussed in Section 2.5.3.2.

TM8 - Monitoring Well Installation Plan - IHSS 115. This TM provided a revised FSP for the installation and sampling of monitoring wells in the vicinity of IHSS 115 as prescribed by the OU5 Work Plan. Subsequent to the preparation of the draft version of this TM, it was determined that the intent of the Work Plan was such that a TM was no longer required to define the locations of these monitoring wells. Therefore, a letter was prepared that described the plan for installing and sampling monitoring wells at IHSS 115. This letter is presented in Appendix A, and the groundwater monitoring program is discussed in Section 2.4.4.3.

TM9 - Monitoring Well Installation Plan - IHSS 133 (EG&G, 1993g). The installation of monitoring wells in the area of the IHSS 133 sites was proposed in the OU5 Work Plan, and the Work Plan specified that a TM be prepared to define the locations of these wells. TM9 provided a monitoring well installation and sampling program for the installation of wells based on the results of previous investigations in the IHSS 133 area. The implementation of this TM and the results of this investigation are discussed in Section 2.5.4.1.

TM10 - Soil Sampling Plan - Surface Disturbance Areas (EG&G, 1993h). TM10 presented a FSP for the collection of surface and subsurface soils at IHSS 209, the Surface Disturbance West of IHSS 209, and the Surface Disturbance South of the Ash Pits. The OU5 Work Plan did not indicate that a TM would be required for these sampling programs, but information obtained in previous stages of the investigation of these areas necessitated that the soil sampling program described in the Work Plan be modified. This information indicated that there was no evidence of waste disposal in these areas, and the soil sampling programs were reduced in scope so as to only confirm the results of the preceding investigations. A detailed discussion of the rationale for reducing the scope of these activities and the results of the implementation of this TM are provided in Sections 2.7.3.2 and 2.7.3.3.

As indicated above, during the course of the Phase I investigation several letters were sent to further clarify the field work proposed by the OU5 Work Plan (Appendix A). The first of these letters clarified the activities planned to further investigate anomalies detected by the soil gas survey at IHSS 115 (see Sections 2.4.2.2 and 2.4.3.3). The second letter, discussed above, replaced TM8 and defined the locations of groundwater monitoring wells at IHSS 115 (see Section 2.4.4.3). The third and final letter described a soil boring program planned to investigate an anomaly west of the IHSS 133 area that was identified by the magnetic survey (see Section 2.5.3.3).

2.2 FIELD INVESTIGATION PROCEDURES

All field investigations conducted during the OU5 Phase I RFI/RI were performed in accordance with the applicable RFP Standard Operating Procedures (SOPs). More specifically, the procedures followed are those contained in the following volumes of the Environmental Management Division Operating Procedures Manual (5-21000-OPS):

- Volume I: Field Operations (5-21000-OPS-FO) (EG&G, 1992b),
- Volume II: Groundwater (5-21000-OPS-GW) (EG&G, 1992c),
- Volume III: Geotechnical (5-21000-OPS-GT) (EG&G, 1992d), and
- Volume IV: Surface Water (5-21000-OPS-SW) (EG&G, 1992e).

During the course of this project, several Document Change Notices (DCNs, now known as Document Modification Requests (DMRs)) were prepared to modify the existing procedures for specific application to the OU5 sites. The discussions of the implementation and results of the Phase I field activities in Sections 2.4 through 2.7 provide the details of the procedures followed for each activity, including any modifications.

2.3 DATA ANALYSIS AND BACKGROUND COMPARISONS

To determine the nature and extent of the environmental impact potentially resulting from waste disposal activities at the OU5 sites, it is necessary to determine any contribution from natural sources. When available, background data from the 1993 Background Geochemical Characterization Report (EG&G, 1993i) are used in this TM to quantify the contribution from natural sources. This report presents background chemistry data for borehole materials for the different geologic and hydrostratigraphic units (flow systems), stream and seep/spring sediments, groundwater samples from the different geologic units and flow systems, and surface-water samples from locations "upgradient" of RFP. To date, background concentrations have not been established in the Background Geochemical Characterization Report for surface soils at RFP. Several soil samples have been collected from the Rock Creek drainage northwest of RFP. The data for these samples are used as representative of background concentrations for surface soils in this TM.

For each of the environmental media, the Background Geochemical Characterization Report provides descriptive statistics which can be used for comparison to site (non-background) data to initially assess the degree of contamination present. Tables 2.3-1 through 2.3-7 provide summaries of the descriptive statistics for environmental media pertinent to the OU5 RFI/RI. Comparisons of non-background data to background data, as reported in Sections 2.4 to 2.7, were performed principally using the Background Upper Tolerance Limit (BUTL), or both the BUTL and the Background Lower Tolerance Limit for pH. Non-background data that exceed the BUTL for a particular constituent were used as an initial indication of the presence of contamination. Geologic, geochemical, and hydrologic principals were then applied to determine the significance of the statistical results and the nature of contamination. For instance, common rock-forming elements (e.g., calcium, potassium, sodium, and magnesium) are often identified as being present in concentrations exceeding their respective BUTLs. The concentrations of these elements are expected to vary widely in a natural environment, and above-background concentrations are generally not considered to be indicative of contamination.

For the purposes of this TM, the BUTL for all organic compounds (volatiles, semi-volatiles, pesticides, and polychlorinated biphenyls (PCBs)) was considered to be the detection limit (i.e., any detected organic compound was considered to be present in concentrations exceeding background). As presented in Sections 2.4 to 2.7, several common laboratory contaminants (e.g., acetone, methylene chloride, and certain phthalates) were frequently detected in samples. Where laboratory blank data are available, the concentrations of these compounds in samples were compared to the laboratory blank results to determine whether the detection of these compounds in the samples was indicative of site contamination. If the concentration of these compounds in the sample was greater than 10 times the lab blank concentration, the result was not attributed to laboratory contamination. Similarly for organic compounds not normally consider laboratory contaminants, if the concentration of these compounds in the sample was greater than five times the laboratory blank concentration, the result was not attributed to laboratory contamination. Since the data validation process is continuing, it is possible that more of the results for organic compounds discussed in Sections 2.4 to 2.7 may be attributed to laboratory contamination.

As noted above, for the purposes of this TM the comparison of site data to background concentrations consisted only of a comparison to BUTLs. For those analytes where BUTLs were not provided by the Background Geochemical Characterization Report, the maximum background concentration was used for this comparison. This approach is believed to be adequate for providing an initial indication of the presence of contamination at an IHSS and for determining where additional data may be required to satisfy the objectives of the OU5 RFI/RI.

This approach appears to be particularly valid for the purposes of this TM in that the data that are absent for many IHSSs pertain to physical characteristics (e.g., the presence or absence of an ash pit) rather than chemical characteristics. When all of the samples collected under each stage of the Phase I RFI/RI have been analyzed, a larger suite of statistical tests (the Gilbert Methodology) will be applied to these data to determine site contaminants that will be evaluated in the risk assessment process.

BUTLs for metals and radionuclides were calculated from a suite of soil samples designated as the Rock Creek-18. These samples were collected from the northwestern buffer zone and are believed to be representative of surface soil chemistry that is unaffected by operations at RFP.

The Rock Creek-18 data were retrieved from EG&G's Rocky Flats Environmental Data System (RFEDS) and cleaned up according to the guidance contained in Appendix B. After the data were cleaned up, data sets for each analyte were evaluated to determine if the sample population was greater than 10 and if greater than 50 percent of the reported concentrations were actual detected values. Upper tolerance limits were calculated for data that satisfied these criteria. The data were then evaluated for normality using the probability plot, correlation coefficient method where the linear correlation coefficient between the data and their normal quantiles are computed, and the result is compared to published critical values of r* (alpha = 0.05) for the probability plot, correlation coefficient test of normality (Helsel, et al., 1992).

Upper tolerance limits were calculated for normally-distributed data according to the following equation:

$$L_{99} = X + Ks$$

where L_{99} = upper 99 percent tolerance limit
X = mean of the sample population
K = normal tolerance factor at 99 percent coverage and 99 percent confidence
s = sample standard deviation

Upper tolerance limits for data that were not normally distributed were calculated according to the following equation:

$$L_{99} = X_l + Ks_l$$

where L_{99} = upper 99 percent tolerance limit
X_l = back transformed mean of the log-transformed data
K = normal tolerance factor at 99 percent coverage and 99 percent confidence
s_l = back transformed sample standard deviation of log-transformed data

Table 2.3-2 lists upper tolerance limits for metals and radionuclides for the Rock Creek-18 samples.

Data obtained from the analysis of samples collected under the OU5 RFI/RI were cleaned up in accordance with guidance prepared by the EG&G Geosciences Department (Appendix B). The cleanup process consists of several steps that must be completed to transform the raw RFEDS data into a data set that contains only that information that is pertinent to the comparison of site data to BUTLs. The actions performed during the clean-up process included:

- Data rejected during the validation process are removed.
- Duplicate records that contain the same information for a sample are removed.
- Quality control data, with the exception of field duplicates, are removed from the data set and placed into a separate data set for analysis.
- Unvalidated data are replaced with validated data, if available.
- Data qualified as being unusable are removed.
- Data for diluted samples are modified as appropriate.
- Results less than the detection limit are replaced with an appropriate value.
- Results for field duplicate pairs are averaged.

Appendix B contains data sets that resulted from the cleanup process for OU5 samples. These data sets are grouped by the major analytical groups routinely reported by RFEDS - metals, radionuclides, water quality parameters, volatile organic compounds (VOCs), semi-volatile organics compounds (SVOCs), pesticides, and PCBs. The data presented in Appendix B are those data that were used for the evaluations discussed in Sections 2.4 through 2.7 of this TM. Table 2.3-8 illustrates the status of the analysis and validation of samples collected under the OU5 RFI/RI as of January 28, 1994.

2.4 IHSS 115 (ORIGINAL LANDFILL) AND IHSS 196 (FILTER BACKWASH POND)

As discussed in Section 1.2.1.1, the investigation of IHSS 115 (Original Landfill) also encompassed the area of IHSS 196 (Water Treatment Plant Filter Backwash Pond). The following sections discuss the implementation and results of the Phase I investigation of both sites.

2.4.1 Stage 1 - Review of Existing Data

Stage 1 activities specified by the OU5 Work Plan for IHSS 115 included reviewing aerial photographs taken during the operation of the Original Landfill to identify the extent of disposal operations. Stage 1 also involved review of the results of a gamma radiation survey conducted in 1990 and review of any additional studies conducted subsequent to completion of the OU5 Work Plan.

The purposes of the aerial photograph review were to: 1) determine if the mapped IHSS locations and areas shown on Figures 2-2 and 2-6 of the OU5 Work Plan conform to the surface disturbances as identified on vertical aerial photographs; and 2) identify other prominent features, including disturbed ground, mounds, trenches, or depressions not identified in the OU5 Work Plan. The aerial photographs used for this review were vertical aerial photographs from the EPA Aerial Photographic Analysis Comparison Report (EPA, 1988) and a series of oblique aerial photographs obtained from the RFP archives. The vertical photographs from EPA (1988) were taken in the years 1953, 1955, 1964, 1971, 1978, 1980, 1983, 1986, and 1988. The oblique aerial photographs intermittently spanned the period of February 6, 1966 to June 26, 1991.

The review of available aerial photographs resulted in some modifications to the dimensions and boundaries of IHSS 115 shown in the OU5 Work Plan. These modifications are summarized below and shown on Figure 1.2-2.

- A suspect area shown as disturbed ground and a possible pit off the west end of IHSS 115 were identified.

- The surface disturbance east of the landfill was enlarged to include an area interpreted as rubble piles east of the road on the east side of the surface disturbance. This interpretation is based on an evaluation of oblique aerial photographs taken in December 1987 that clearly define the rubble piles. This rubble is interpreted as material used to construct a collection basin for the discharge outlet for the outfall pipe shown on Figure 1.2-2.

- The original outfall pipe, now abandoned, was constructed in 1986 and was extended to the south by a corrugated metal flume. The buried outfall pipe extending to the southeast was added in either 1987 or 1988. The construction of both storm-sewer pipes would have resulted in the displacement and reburial of a substantial amount of landfill material.

- The drainage ditch shown to the east of the outfall pipes was visible on vertical aerial photographs from 1955 through 1981 and was apparently covered or partially filled by 1983. The ditch is clearly visible on oblique photographs taken in 1967 and 1969 which show a culvert under the railroad tracks and probably under the main road. There is no photographic evidence that the culvert was removed, sealed, or extended before the ditch was covered.

- The berm shown to the south of the west end of the landfill was under construction in oblique photographs taken on November 15, 1967. Oblique photographs taken on June 5, 1969; July 11, 1969; and May 15, 1970 show the area behind the berm (north side) in various stages of being filled with rubble and a number of large unidentifiable objects. It may be significant to note that one of the uranium-238 anomalies detected by the 1990 high purity germanium (HPGe) survey described later in this section occurred just to the south of this berm.

- Oblique photographs show that the pond identified on the 1955 vertical aerial photograph (IHSS 196) and interpreted to be filled in on subsequent photographs appears to have been completely washed out in later years. Consequently, any sludge or sediments that would have accumulated when the pond was in use may have spread out below the pond site or been deposited in Woman Creek prior to the construction of the SID.

- Aerial photographs indicate that the landfill was operated as an area fill. Waste appears to have been dumped over the southern edge of the alluvial pediment on which RFP is located and spread over the southerly-facing slopes incised by Woman Creek. Groundtruthing, conducted as part of the aerial photograph review process, indicated that the landfill cover is intact above a topographic break near the center of the landfill which signifies the upper edge of a slump. Below the topographic break, the cover appears to be eroded with numerous small slumps, which locally expose some of the waste.

During the period from October 25, 1990 to December 8, 1990, a gamma radiation survey was conducted over the area of IHSS 115 and 196 using a 20 percent N-type, HPGe detector (DOE, 1992a). The survey data are presented in Volume II, Appendix B, of the OU5 Work Plan. This investigation found that radiation in the soil was contributed from potassium, uranium, and thorium. Radium and cesium were also measured indirectly from daughter isotopes. Review of these data indicates that activity from most of the detected isotopes was consistent with natural background; however, there were areas that exhibited elevated uranium-238 activity (hot spots). These hot spots are shown on Figure 2.4.1-1.

Cesium-137 is a human-made fission product deposited by fallout from worldwide nuclear testing (Eisenbud, 1973). After several conversations with the manager of the HPGe program, it was determined that the cesium-137 survey data could be used to delineate areas where the soil cover has remained undisturbed for several decades. Fallout concentrations of cesium-137 over a given undisturbed area are expected to be relatively consistent. Cesium-137 concentrations over known undisturbed areas surrounding the landfill were identified to be consistently close to 0.4

picocuries per gram (pCi/g) and values over known disturbed areas were significantly less. A value of at least 0.4 pCi/g of cesium-137 was selected as a limit to define undisturbed areas within the survey boundaries. This method delineates an area of possibly undisturbed ground that was found to be consistent with the original topography of the site as was determined from an examination of aerial photographs of the area (see TM5, Figure 2).

Additional conclusions drawn from the HPGe survey are summarized below.

- Volume II, Appendix B, Figure 5 of the OU5 Work Plan shows contours for a large anomaly located over the central portion of the landfill. This anomaly encompasses survey stations C-8, C-9, B-7, and B-8 shown on Figure 2.4.1-1. This anomaly may be a composite of point sources, although this cannot be determined from the available data. These areas were subsequently surveyed using a Field Instrument for the Detection of Low Energy Radiation (FIDLER) (Section 2.4.2.3).

- Anomalies at stations D-3 and P-2, detected to the south and east of the landfill, respectively, appear to be related to landfill material that was excavated during the construction of the SID.

- The location and source for the anomaly at station SP-2 is documented by photographs 19, 20, and 21 in "Photographs of Woman Creek, OU5" (Appendix C). The description for one of the photographs includes the coordinates of the source, which exactly coincides with the coordinates of survey station SP-2. The photographs show the object identified shortly after the 1990 HPGe survey as the source for the anomaly at station SP-2 protruding through the landfill cover material.

Based upon this review of the 1990 HPGe survey, the locations of all hot spots identified were surveyed and marked with stakes for subsequent radiological surveys (Section 2.4.2.3) and sampling activities (Section 2.4.3.1).

2.4.2 Stage 2

Stage 2 activities at IHSS 115 consisted of geophysical and soil gas surveys, as were specified in the OU5 Work Plan. In addition, a radiological survey with a FIDLER was conducted to supplement the 1990 HPGe survey discussed in the previous section.

2.4.2.1 Geophysical Surveys

Frequency-domain EM and magnetometer geophysical surveys were conducted in IHSS 115 from October through December 1992. The performance of these surveys was specified by the OU5 Work Plan and further detailed in TM2 (EG&G, 1992a). Implementation and results of these surveys are discussed in this section.

Frequency-domain EM surveying is used to determine ground conductivity and conductivity anomalies associated with such things as buried waste pits and trenches, landfills, sludge lagoons, buried drums, or leachate plumes. A continuous transmitted primary EM field creates an eddy current flow in the subsurface. This induces a smaller secondary EM field which is measured by the geophysical instruments in the presence of the larger primary field. The components of this field are the quadrature phase component (measuring ground conductivity) and the in-phase component ("metal detection" mode). Effective penetration depth is on the order of 15 ft.

Magnetometer surveying is used to delineate locations of metallic objects such as buried drums or pits/trenches/landfills with ferromagnetic debris by measuring local variations in the earth's magnetic field caused by these objects.

2.4.2.1.1 Introduction

The geophysical survey originally proposed for IHSS 115 in the OU5 Work Plan covered a rectangular area of approximately 600 by 1,700 ft and was to be performed on a 25-foot grid. The OU5 Work Plan further specified that a TM be prepared to fully detail the grid spacing, geophysical techniques, and procedures to be followed. The details of the geophysical survey and the results of the activities conducted in previous stages (i.e., the review of existing data, including aerial photographs and the 1990 HPGe survey) are presented in TM2 (EG&G, 1992a). In addition, a revised FSP for the geophysical survey is also defined in TM2. As a result of the aerial photograph review, the area to be surveyed was extended 250 ft east to include the additional rubble piles identified on a 1988 aerial photograph. The northern boundary of the geophysical survey was moved 25 ft south to avoid the chain link fence at the buffer zone perimeter. Concurrently, the southern boundary was extended 65 ft south to include all of IHSS 115, to provide more coverage over the gamma radiation anomaly identified southwest of the landfill and to provide delineation of the 8-inch gas line.

Using Colorado State Plane Coordinates, the area surveyed is enclosed by the following:

SW Corner: N747,490	E2,080,850
SE Corner: N747,490	E2,082,800
NE Corner: N748,090	E2,082,800
NW Corner: N748,090	E2,080,850

A baseline for the north coordinate boundary was land surveyed parallel to and along N747,700. This baseline was assigned a coordinate of zero; all north or south coordinates are referenced to this line. The baseline was measured and marked by visible flagged stakes along its entirety each 25 ft. TM2 specified that north-south grid-traverse lines be spaced 25 ft apart and that readings be taken at 10-foot intervals along each grid traverse to increase the resolution of the survey. The east coordinate boundary was assigned a coordinate of zero at E2,080,850; all east-west locations are referenced to this baseline.

The geophysical techniques to be employed during this survey were also specified in TM2. A magnetometer survey using a Scintrex/EDA Omni (or equivalent) and an EM survey using a Geonics EM-31 were specified in TM2. The survey procedures followed are outlined in Section 2.4.2.1.2.

2.4.2.1.2 Survey Procedures

The geophysical surveys were conducted in accordance with SOP GT.18. Trial survey traverses were made across OU5 from north to south using magnetometer and EM instruments. Following these traverses, the data were reviewed to evaluate influence and intensity of known cultural features in order to characterize their responses.

The site selected for the fixed base station magnetometer was pre-scanned over a 25-foot radius to assure that no visible or buried ferromagnetic materials were present.

Grid traverse lines were followed during the geophysical survey. Beginning at the north boundary line, southern traverses with the geophysical instruments were made along each grid traverse line bearing due south and controlled by compass. At each 10-foot division along the grid traverse line, instrument readings were recorded for total magnetic field intensity, magnetic gradient, vertical dipole conductivity (quadrature phase) component, and vertical dipole in-phase component along with grid traverse location coordinates.

To assure reproducibility of the geophysical survey data recorded by the designated EM and magnetic instruments, the following field procedures were implemented:

- A location was selected in OU5 to establish a geophysical survey control station (GSCS) that was separated from visible interferences to the instruments.
- The area around the GSCS was cleared with each instrument to assure that subsurface station conditions were constant with respect to total magnetic field and conductivity (in-phase and quadrature components).
- Total magnetic field and conductivity values were recorded with the designated grid-roving instruments at the GSCS.
- Any site changes that could affect the values at the GSCS, such as precipitation or snow cover, were noted.
- A check for instrument reproducibility was implemented at the GSCS during each day of the geophysical survey. The GSCS was reoccupied at the start of the survey, at mid-day, and at the close of the work day. The measured values obtained with the designated grid-roving instruments were documented.

The data were analyzed using Geosoft computer software and then contoured in color to generate the following maps:

- Total magnetic field,
- Magnetic gradient,
- Vertical dipole conductivity (quadrature phase), and
- Vertical dipole in-phase.

Conductivity and magnetic data were then interpreted using contour maps, profiles, and surface features maps. The geophysical maps for IHSS 115 that have been included in this TM are total magnetic field and vertical dipole conductivity (quadrature phase) maps. Other maps are not included because they offer little additional information. Results of the geophysical surveys are presented in Section 2.4.2.1.3.

2.4.2.1.3 Results

The magnetometer survey conducted at IHSS 115 was evaluated for indications and locations of buried ferromagnetic objects. Such objects may be an indication of buried waste, thereby indicating possible IHSS boundaries.

The magnetic data (Figure 2.4.2.1-1) exhibit an anomalous area centered near coordinates 200N, 1000E coinciding to the location of the landfill. This presumably is associated with buried metallic objects in the landfill. The data also reveal areas of interest including the Radiologically Controlled Area (RCA) (near coordinates 160N, 400E) associated with the landfill bank slump where the metallic uranium-238 source was identified, buried metallic objects in the vicinity of IHSS 196 (coordinates 130N, 750E), and the area over the east half of the outfall pipe (linearly extending from coordinates 300N, 1275E to 120N, 1800E). Manholes associated with the outfall line were also identified by the magnetic survey. It is possible that the depth of the west end of the outfall line exceeded the detection depth of the magnetometer, or that a non-detectable concrete pipe was used between the two manholes.

Useful data could not be acquired beneath the power lines due to the overriding EM interference produced by the lines.

The EM survey conducted at the Original Landfill helped to characterize the landfill boundaries by conductivity differences between native and disturbed soil. The EM conductivity data (Figure

2.4.2.1-2) exhibit an anomalous area of higher conductivity (80 to 110 millimhos per meter (mmhos/m)) extending from coordinates 50N to 350N and 625E to 1100E. This coincides to the known location of the Original Landfill. This anomalous area may be attributed to the higher moisture content of disturbed ground, an extensive amount of landfill cover material or disturbed sediments, differences in geological sediments, or buried conductive metallic objects. The large anomaly occurring in the main portion of the landfill correlates with the area in which the most intensive magnetic anomalies occur and may be attributed in part to buried metallic objects.

Cultural features delineated by the EM survey include two buried gas pipelines, located along the north and south boundaries of the Original Landfill, and the conductivity anomaly associated with the east end of the buried metallic outfall line. It is possible that the thickness of cover material along the west end of the outfall line exceeds the penetration depth of the EM instrument, or that the west end of the pipe is nonmetallic. Contour maps also show partial linear anomalies along the SID and partial linear anomalies associated either with an abandoned gas line and/or the overhead power lines that extend east-west along the south boundary of the landfill.

2.4.2.2 Soil Gas Survey

A real-time soil gas survey was proposed as part of the Phase I RFI/RI field investigations in the OU5 Work Plan. The purpose of this survey was to identify areas of volatile organic contamination within IHSS 115 and IHSS 196.

2.4.2.2.1 Introduction

VOCs that may have been placed in this landfill include commonly-used solvents, such as TCE, carbon tetrachloride, PCE, petroleum distillates, 1,1,1-TCA, DCM, benzene, paint, and paint thinners (DOE, 1992a).

The purpose of the soil gas survey was to provide Phase I screening-level data concerning the presence or absence of VOCs at the Original Landfill, including IHSS 196, and the disturbed area east of the Original Landfill (DOE, 1992a). Anomalous readings encountered during the survey were further investigated by additional soil gas sampling. Plumes of VOCs identified by the soil gas survey were further assessed by the subsequent drilling of soil borings within the plumes and installation of groundwater monitoring wells downgradient of the plumes (Section 2.4.3.3).

TM5 presented the proposed soil gas sampling locations and methods. This memorandum incorporated the available information from the IAG, the OU5 Work Plan (DOE, 1992a), results of the 1990 HPGe survey, results of the November 1992 EM and magnetometer surveys, SOPs GT.09 and FO.03, and specifications supplied by the subcontractor who was to perform the soil gas survey. These documents, survey results, and subcontractor specifications provided the basis for determining the locations of the soil gas sampling sites.

TM5 was modified by a February 15, 1993 DCN that was formalized by the May 4, 1993 revision of TM5. The modification was necessary to implement a more representative definition of anomalous soil vapor concentrations. Previously, the definition of an anomalous soil vapor concentration for any given analyte was that which was greater than three times the detection limit for that analyte. It was necessary to develop slightly greater reporting limits because the sensitivity of the portable gas chromatograph was such that it was detecting the small quantities of DCM, PCE, and TCE present in the Teflon of new syringes. Consequently, small concentrations of volatile organic vapors from the soil gas survey were detected above the detection limit; however, these small concentrations did not necessarily indicate the presence of a subsurface plume of VOCs.

The OU5 Work Plan specified that soil gas samples be collected on a 100-foot grid over the Original Landfill and the disturbed area to the east. The grid was to be reduced to 25-foot spacing at the downgradient perimeter of the landfill, over areas of suspected buried metallic materials based on the EM and magnetometer surveys (Section 2.4.2.1), and over areas where volatiles are found during the 100-foot grid soil gas survey. This 25-foot soil gas grid spacing around the downgradient perimeter was to include at least the area between the last 100-foot grid location within the landfill area and the first 100-foot grid location outside the landfill area. Furthermore, the 25-foot soil gas grid located over metallic materials or volatile plumes was to continue for at least 50 ft beyond the edge of the anomaly.

However, operational data from recent soil gas surveys conducted at RFP were utilized in conjunction with a transient subsurface pressure distribution equation (Johnson, et al., 1990) to assess the radius of influence of this soil gas survey. As presented in TM5, a 10-foot radius of influence was estimated to be achievable under the operating conditions expected at the Original Landfill. A more efficient sampling plan was proposed and executed on this basis. Figures 2.4.2.2-1 through 2.4.2.2-3 (discussed in Section 2.4.2.2.3) present the soil gas sample locations.

The survey was performed using primary, secondary, and tertiary grids. The primary soil gas survey encompassed the entire landfill area on a 100-foot grid, as specified in the OU5 Work

Plan. However, various surface features (such as RCAs), water-saturated areas, and very steep slopes) precluded soil gas sampling at some sites.

The downgradient perimeter of the landfill was surveyed at 40-foot intervals that comprised a primary three-row, triangular (equilateral) grid. Based on the 10-foot radius of influence, this spacing should have provided adequate coverage with respect to vapor flow paths occurring perpendicular to the survey. This mesh of sample locations was intended to detect discrete rivulets of VOCs at the downgradient landfill perimeter.

In addition, the coverage of magnetic anomalies consisted of a secondary 50-foot triangular grid. Magnetic anomalies that were too small to be covered by such a grid were surveyed with a 25-foot grid. However, the magnetic anomalies occurring along the buried outfall pipe were not included in the 50- or 25-foot grid, because these magnetic anomalies had been determined to be caused by the outfall pipe, not by buried waste.

The results of the primary and secondary soil gas surveys were used to assess the locations of soil gas anomalies. Concentration anomalies were defined as those greater than the reporting limit for any of the six analyzed constituents. Soil gas anomalies triggered the collection of additional samples on a tertiary grid with 20-ft spacing. The additional 20-foot samples extended to the first such sample at which the soil gas concentration was no longer in the anomalous range. A comparison of proposed and actual sample distributions is as follows:

Grid Type	Proposed No. of Samples	Actual No. of Samples
100-foot spacing	73	74 Plus 6 duplicate samples
40-foot spacing	174	174 Plus 17 duplicates
50-foot spacing (Secondary Grid)	96	91 Plus 11 duplicates. High water table precluded sampling at
Verification Sampling	10 percent	25 Plus 3 duplicates
DCM Verification	Not proposed	12 Plus 1 duplicate
20-foot spacing	Not determined at time of	60 Plus 6 duplicates
TOTALS	343 plus duplicates, verification, and anomaly chases.	339 Plus duplicates, verification, and anomaly chases (480 total).

The DCM verification was conducted prior to the approval of the use of reporting limits. The verification appeared necessary due to the observation of DCM concentrations exceeding three times the detection limit (but below the reporting limit approved by EPA and CDH). Seven sites exhibiting greater than three times the detection limit were resampled, as were five sites exhibiting less than three times the detection limit.

2.4.2.2.2 Survey Procedures

Prior to the soil gas survey, the soil gas sample locations were surveyed with a FIDLER. Immediately prior to sampling a location, the ground surface was surveyed to measure alpha and beta-gamma radiation. All radiological measurements were performed in accordance with SOP FO.16, as amended by DCN 92.05.

Soil gas sampling methods were in accordance with SOP GT.09. The soil gas sampling system included a truck-mounted hydraulic probing apparatus and hollow steel soil probes with gas sampling tips. A manual probing apparatus was used for sampling sites that were inaccessible to the truck-mounted system.

Typically, the soil sampling probes were pushed into the ground using a *hydraulic ram system* mounted on the back of a pick-up truck. However, in areas where the steep terrain precluded the use of the truck, the sampling probes were hand driven. The probe is a hollow steel rod with a retractable tip allowing for the soil vapor entry into the rod. This system has the advantage of extraction of soil vapor samples from discrete soil intervals without the introduction of surface air into the hole. As specified in the OU5 Work Plan (DOE, 1992a), the probes were set at an approximate depth of 5 ft. Immediately subsequent to the probe installation, the vapor in the headspace of the probe was surveyed with an organic vapor meter (OVM) to measure vapor concentrations for both health-and-safety and initial-concentration assessments. In order to facilitate collection of representative vapor samples, the sample hole was purged of vapor for 5 minutes prior to sample collection. During this time, the pump vacuum-gauge readings were monitored to ensure that steady state had been achieved within 5 minutes. The 5-minute reading was converted to a vapor flowrate through the use of the pump calibration curve. Prior to sample collection, the pump was turned off (but still connected so as not to introduce surface air into the probe headspace), and the vacuum readings were monitored until returning to background levels. At this time, the soil vapor in the formation was considered to have equilibrated. The samples were recovered with a vacuum gas sampling system connected by vacuum hose directly through the probe to the sampling tip. The samples were collected with a gas-tight syringe and injected directly to the gas chromatograph.

For locations requiring the hand-driven probing apparatus, the procedures used were the same, except the probes were installed by hand, and the vapor was purged by a hand pump. The pump was previously calibrated to purge 3.6 liters for every 100 depressions of the hand trigger.

The mobile analytical facility included a Hewlett Packard 5890A gas chromatograph with a 75-meter megabore capillary column and simultaneous Photoionization Detector/Electron Capture Detector systems. Data acquisition was performed using a Perkin Elmer Omega II computerized data system. Analyte separation was performed by a RESTEK Rtx 502.2 (60 meter (m) x 0.53 millimeter (mm)) megabore gas chromatograph column used in conjunction with temperature programming. Power was supplied by 110-volt line power.

The soil gas samples were analyzed by the procedures presented in TM5. All samples were analyzed within 5 hours of sample collection.

Analytical results were presented in units of micrograms per liter (μg/L), the unit of measurement specified in EPA analytical-methods references. Conversion to percentage, parts per million (ppm) or parts per billion is dependent upon several factors, including the molecular weight of the individual compounds, air temperature, and air pressure. Detection limits are a function of detector type, injection volume, and specific analyte response. Detection limits for the listed analytes were in the sub-μg/L range and are listed below, along with the approved reporting limits:

Analyte	Detection Limit (μg/L)	Reporting Limit (μg/L)
Benzene	1.0	1.0
DCM	0.75	10.0
1,1,1-TCA	0.25	2.0
Carbon Tetrachloride	0.10	1.0
TCE	0.25	1.0
PCE	0.30	1.0

As detailed in TM5, EPA Level II Quality Control (QC) was provided by the soil gas survey subcontractor. Level II QC is defined as field screening/analytical methods that utilize sophisticated analytical instrumentation that may be set up in a mobile analytical facility. TM5 details the procedures for instrument calibration, preparation of standards, and quality control.

2.4.2.2.3 <u>Results</u>

Field data collected for each sample include the following:

- sample time;
- approximate ambient temperature;
- depth of sample collection;
- headspace organic vapor concentrations prior to purging and subsequent to sampling;

- headspace methane and carbon dioxide (not measured at all locations);
- vacuum gage readings from the soil vapor extraction pump at 5, 15, and 30 seconds, and at 1, 2, 3, 4, and 5 minutes from the beginning of the purge interval;
- alpha and beta-gamma radiation readings at the ground surface; and
- beta-gamma radiation readings of the sampling probes (after sampling and withdrawal).

The field measurements and laboratory results are presented in order by RFP coordinates in Appendix D.1 through D.3. The laboratory results are summarized as follows:

Constituent	Maximum Concentration (μg/L)	No. of Locations at Which Concentration Exceeded Reporting Limit	Total No. of Locations Sampled*
Benzene	0.11	0	339
DCM	8.4	0	339
1,1,1-TCA	13.0	2	339
Carbon Tetrachloride	0.023	0	339
TCE	28.0	9	339
PCE	7.6	9	339

* Does not include duplicate or verification samples.

Appendix D.3 indicates more exceedances of the reporting limit than are presented in this summary. This is due to the Appendix's inclusion of verification and duplicate samples, whereas the above summary pertains to unique locations.

The survey resulted in the identification of three areas of anomalous concentrations of organic compounds. Figures 2.4.2.2-1 through 2.4.2.2-3 present the concentration isopleths for 1,1,1-TCA, TCE, and PCE, the three constituents for which concentrations above the reporting limits were found. For locations at which more than one sample was collected (e.g., duplicates and verification samples), only the highest concentration was used on the figures to present the most conservative scenario.

The plume identified as "Area A" on the figures is near the center of the landfill, east of the abandoned storm sewer pipeline, and approximately 80 ft north of the SID (the approximate coordinates of the center are N747,815 and E2,081,950). Two sample locations were observed to exhibit concentrations above the reporting limit for 1,1,1-TCA and TCE. The maximum concentration of 1,1,1-TCA was observed to be 13 μg/L; the maximum concentration of TCE was 19 μg/L at this location (Figures 2.4.2.2-1 and 2.4.2.2-2, respectively). In Area A, no other constituents were found above the reporting limit.

The plume labeled as "Area B" is west of Area A and north of the former locations of the ponds (IHSS 196) (the approximate coordinates of the center are N747,935 and E2,081,650). Seven locations exhibited TCE concentrations above the reporting limit; the maximum concentration observed was 28 μg/L (Figure 2.4.2.2-2). PCE concentrations were observed above the reporting limit at eight locations; the maximum concentration was 7.6 μg/L (Figure 2.4.2.2-3).

"Area C" is south of Area B (at approximately N747,845 and E2,081,575). PCE was detected at 1.2 μg/L at one sample location (Figure 2.4.2.2-3).

Plumes of VOCs identified by the soil gas survey were further assessed by drilling soil borings within the plumes (see Section 2.4.3.3) and installing groundwater monitoring wells downgradient of the plumes (see Sections 2.4.4.2 and 2.4.4.3).

In July 1993 (subsequent to completion of the soil gas survey), a small-scale intrinsic air permeability study was conducted in and adjacent to IHSS 115. The purpose of the study was to assess the intrinsic air permeability of the IHSS 115 area with more precision than the general order-of-magnitude estimates provided in charts of permeability versus soil type.

The study was conducted by installing three soil gas probes to equal depths with the truck-mounted system. A vacuum was exerted on one probe while the gauge readings were monitored on the other two probes in relation to elapsed time. This exercise was repeated several times to provide statistical data. The outcome was a series of data sets of vacuum reading versus time with which to assess horizontal permeability. Then the depths of the two monitoring probes were altered and the exercise repeated so that the vertical permeability could be assessed. This procedure was conducted outside of the southeast pre-SID perimeter of IHSS 115, at approximate coordinates of N747,608 and E2,082,442. The procedure was repeated inside IHSS 115, near the center, at approximate coordinates N747,824 and E2,081,496.

By manipulating the transient subsurface pressure distribution equation (Equation I), the intrinsic air permeability can be calculated from the slope of the line of vacuum gauge readings versus the base-ten logarithm of elapsed time readings (Equation II) (Johnson, et al., 1990).

$$P' = \frac{Q}{4\pi m(k/\mu)}\left[-0.5772 - \ln\left(\frac{r^2\varepsilon\mu}{4kP_{atm}}\right) + \ln(t)\right]$$

(Equation I)

where:

P′ = "gauge" pressure measured at distance r and time t
m = stratum thickness (3 m)
r = radial distance from vapor extraction well
k = soil permeability to air flow ($5.0\text{x}10^{-2}$ to $1.52\text{x}10^{-1}$ darcies)
μ = viscosity of air ($1.8\text{x}10^{-4}$ g/cm-s)
ϵ = air-filled soil void fraction (0.10)
t = time
Q = volummetric vapor flow rate from extraction well (0.70 to 0.97 scfm)
P_{atm} = ambient atmospheric pressure = $1.013\text{x}10^{6}$ g/cm-s^2.

$$k = \frac{2.30uQ}{4\pi mA}$$

(Equation II)

where A is the slope of the vacuum gauge versus log-time line.

The data for the intrinsic air permeability study and the resulting graphs are presented in Appendix D.4. The average calculated intrinsic air permeabilities were 378 darcies outside IHSS 115 and 89 darcies inside IHSS 115. According to one chart of expected permeabilities versus soil type (Johnson, et al., 1990), the air permeability of clayey soils (which are expected to occur in OU5) should be no greater than 0.1 darcy. This chart indicates the calculated permeabilities are more representative of high-permeability sands or gravels. Two possible explanations of the discrepancy between the expected and the calculated permeabilities are that the soils at the test sites are not clayey or that short circuiting of the vapor flow path occurred during the test. Short circuiting is the drawing of fresh air through the subsurface formation from a point near the vapor extraction well instead of drawing the subsurface vapors that are further from the well. The subsurface vapor is then diluted by the fresh air, and consequently, the vapor concentration observed in the laboratory is less than the actual subsurface concentration. Because the test was conducted in the same manner as the soil gas survey, it is possible that short circuiting occurred during the soil gas survey. However, the effects of short circuiting may have been mitigated by the soil gas survey procedure of allowing the subsurface formation to equilibrate between the 5-minute purging and the collection of the soil gas sample. The results of the intrinsic air permeability study require further evaluation to determine the cause of the observed readings (see Section 3.1 of Volume 2).

2.4.2.3 FIDLER Survey

Several areas of IHSS 115 were surveyed with a FIDLER from March through June 1993. The purpose of this survey was to further delineate anomalies identified by the 1990 HPGe survey discussed in Section 2.4.1.

2.4.2.3.1 Introduction

As discussed in Section 2.4.1, the HPGe survey of the IHSS 115 area conducted in 1990 identified ten areas of anomalous uranium-238 activity (Figure 2.4.1-1). Due to the nature of the HPGe survey (i.e., it detects radiation over a relatively large area), it was necessary to perform an additional surface radiological survey to identify the source(s) of these anomalies. The results of this survey would provide information necessary to direct surface soil sampling activities (see Section 2.4.3.1) and to identify areas where it may be necessary to establish barriers (RCAs) to prevent personnel from entering these areas.

2.4.2.3.2 Survey Procedures

The surface radiological surveys performed with the FIDLER at IHSS 115 were conducted in accordance with SOP FO.16, as modified by DCN 93.01, and Environmental Management Radiological Guideline 6.6, as modified by DCN 93.01. These surveys were performed by establishing a square grid measuring 300 ft on each side and centered on each of the HPGe anomalies. Lines on 4-foot spacing were slowly walked while slowly moving the FIDLER in an arcing motion. The display on the FIDLER was carefully watched during this process so as to observe any deflections from background levels. If readings in excess of background were detected, the survey was confined to a smaller area to attempt to identify the source(s) of the radiation detected. Any anomalous areas identified were also surveyed with other field (beta-gamma and alpha) instrumentation.

Areas of radioactivity that exceeded the action levels specified in the OU5 Site-Specific Health and Safety Plan (>2,500 counts per minute (cpm) alpha or >50,000 cpm beta-gamma) required that personnel leave the area and contact EG&G Radiological Engineering. Radiological Engineering personnel surveyed several of these anomalous areas with portable HPGe detectors to determine the radioisotopes present and approximate activities of these radioisotopes. Based on the determinations made by Radiological Engineering, nine areas were cordoned off as RCAs requiring appropriate approval and protective clothing for entry (Figure 2.4.2.3-1).

2.4.2.3.3 Results

The FIDLER surveys of HPGe anomalies at IHSS 115 did not identify any anomalous sources of radiation at HPGe stations C-8, C-9, D-3, P-2, W-2, W-8, and W-11 (Figure 2.4.1-1). The surveys confirmed that the source of the radiation detected at HPGe station SP-2 was a piece of metallic material protruding from the landfill cover. The area where this material is exposed was established as an RCA after the 1990 HPGe survey. No other areas of anomalous activity were detected in the area surrounding station SP-2.

At HPGe stations B-7 and B-8 near the center of the landfill, the FIDLER surveys identified nine areas of anomalous radioactivity. Each of these areas was posted as an RCA (Figure 2.4.2.3-1). The source of radiation in several of these areas was determined to be material that is protruding from the landfill surface. The remaining areas do not contain specific sources of radiation but appear to encompass areas of contaminated soil or contain small particles of radioactive material scattered over a relatively large area. As discussed in Section 2.4.3.1, in those areas where a piece of landfilled material was not identified as the source of the detected radiation, surface soil samples were collected to characterize the contamination present.

At the direction of EG&G Radiological Engineering, several pieces of radioactive material were removed from these areas on May 28, 1993 during an emergency removal action and placed in an area designated for the storage of radioactive material. The materials removed consisted of a 4- to 6-inch diameter piece of concrete coated with a corroded metallic material and several small (1- to 2-inch diameter) spherical pieces of rusty material. Measurements performed by Radiological Engineering indicated that the principle isotope present in these materials was uranium-238, although no quantification of the activity present was provided. During the collection of surface soils (Section 2.4.3.1) several other pieces of radioactive material were removed from these areas. One of these was a rod-shaped piece of material similar to the larger piece described above (Figure 2.4.2.3-1). Analyses conducted by Radiological Engineering determined that this rod contained approximately 25 microcuries per gram (μCi/g) of uranium-238. The analyses of all of the materials removed indicated that the uranium was depleted.

2.4.3 Stage 3

Stage 3 activities at IHSS 115 consisted of the collection of surface soil samples, the drilling and sampling of characterization borings, and further investigation of the anomalies detected by the soil gas survey (see Section 2.4.2.2).

2.4.3.1 Surface Soil Sampling

The collection of surface soils at IHSS 115 was specified in the OU5 Work Plan. The OU5 Work Plan further specified that a TM be prepared to further define the collection and analysis of surface soils. This section of TM15 describes Stage 3 surface soil sampling activities and the resultant analytical data.

2.4.3.1.1 Introduction

The scope of work for the Stage 3 IHSS 115 surface soil sampling program is described in TM3. EPA and CDH approved TM3 in a joint letter to DOE dated December 28, 1992.

TM3 proposed that surface soil sampling be conducted in two phases, the first of which would commence with approval of the sampling plan by EPA and CDH. Phase 1 proposed to collect surface soil samples from an area defined by Stage 1 review of aerial photographs and by review of the 1990 HPGe radiation survey data for IHSS 115. Phase 1 surface soil sampling was proposed to be carried out at the same time that Stage 2 geophysical surveys and the soil gas survey were being conducted. Phase 2 surface soil sampling would be implemented if the Stage 2 field investigations indicated that the areal extent of the landfill was greater than the aerial photos and 1990 HPGe radiation survey indicated.

The Stage 1 review of aerial photographs redefined the boundary of the landfill (Section 2.4.1). The revised boundary also encompassed ten radiation anomalies that were identified by the 1990 HPGe radiation survey. Alternatively, the results of the Stage 2 geophysical surveys (EM and magnetic) indicated no change in the landfill boundary (Section 2.4.1.1). The Stage 2 soil gas survey identified three anomalies, all of which lie within the redefined boundaries of the landfill (Section 2.4.2.2). Based on the results of the Stage 1 data review and Stage 2 field surveys, only the Phase 1 portion of the TM3 sampling plan was required and executed.

The Phase 1 sampling program was designed to include ten biased samples from the radiation anomalies and 51 random samples collected on a grid. The sampling plan also provided for additional surface soil samples to be collected from suspected contaminated areas identified by other ongoing investigations of IHSS 115. FIDLER surveys were among the ongoing investigations and were used to pinpoint the location of the anomalies identified during the 1990 HPGe radiation survey (Section 2.4.2.3). As a result of the FIDLER surveys, two additional surface soil samples were collected.

2.4.3.1.2 Sampling Procedures

Sample locations were identified in the field by means of a compass and measuring tape, and with reference to the baseline surveyed for the geophysical surveys. The location of each surface soil sample was staked at the time the sample was collected. The field procedures used to collect surface soil samples were in accordance with the Rocky Flats (RF) Method, Section 5.0 of SOP GT.08. The equipment used for surface soil sampling was based on the specifications in SOP GT.08, and decontamination procedures were in accordance with SOP FO.03. Sample labeling, shipment, and preservation were conducted according to SOP FO.13. Sample designations, documentation, data package preparation, and sample tracking were conducted according to SOP FO.14.

Surface soil samples for radiological and conventional analyses were collected in using the RF Method. Briefly, this method consists of compositing five soil samples collected from the center and each corner of a 1-meter square at each of the sampling locations shown in Figure 2.4.3.1-1. Each of the five subsamples was collected by driving a 10 by 10 by 5 centimeter stainless steel sampling jig to a depth of 5 centimeters, then a stainless steel scoop was used to extract the jig and approximately 500 cubic centimeters of soil. Each subsample was placed into a stainless steel pan and thoroughly mixed with the other subsamples. A composite sample was collected from the mixed soil.

2.4.3.1.3 Results

Surface soil samples were collected at 66 locations in IHSS 115 (Figure 2.4.3.1-1). Fifty four of the samples were analyzed for target analyte list (TAL) metals, radionuclides, pesticides, PCBs, SVOCs, bulk density, particle size, specific conductivity, carbonate, pH and total organic carbon (TOC). Twelve of the samples were collected at HPGe and/or FIDLER anomalies and were analyzed only for radiological parameters. Two sediment samples were also collected from seeps in IHSS 115 and were analyzed for radionuclides, TAL metals, pesticides, PCBs, SVOCs, and VOCs. These two samples were taken from seeps associated with well points from which groundwater was also sampled (see Section 2.4.4.2). The analytical results available as of January 28, 1994 for surface soil and sediment samples are discussed below. A summary of analyses exceeding BUTLs is given in Table 2.4.3.1-1a for surface soils and Table 2.4.3.1-1b for the seep sediment samples.

Metals. BUTLs were exceeded in 13 of 54 samples for copper, five of 40 samples for zinc, and one of 34 samples for lead. Two of 43 soil samples also exceeded the maximum background concentration for silver. One sediment sample exhibited antimony greater than the BUTL. Locations where BUTLs for metals were exceeded are shown on Figure 2.4.3.1-2.

Radionuclides. Results for five of the 12 surface soil samples collected from HPGe anomalies have been reported by the laboratories, and all five exhibited radioactivity exceeding BUTLs. Uranium-233/234, uranium-235, and uranium-238 exceeded the BUTLs in all five samples, plutonium-239/240 exceeded the BUTL in two of the samples, and americium-241 exceeded the BUTL in one sample. Sample locations where BUTLs were exceeded are shown in Figure 2.4.3.1-3. Results for seven of the 12 samples collected from HPGe anomalies have not been received. These samples displayed anomalous levels of radiation on field instruments. Some of these samples were also analyzed by EG&G Radiological Engineering using a portable HPGe detector. These analyses indicated that uranium-238 is the principal radionuclide present.

Eight of the 54 random surface soil samples exhibited radionuclide activity exceeding the BUTL. Uranium-233/234 exceeded the BUTL in three of the samples, uranium-235 in one of the samples, uranium-238 in all eight of the samples, plutonium-239/240 in two of the samples, and americium-241 in one sample. The counting error for six of these samples was significant in that the result minus the counting error yields an error compensated result below the BUTL. Neither of the two sediment samples from IHSS 115 contained radionuclides with activity greater than the BUTL. The sample locations where BUTLs for radionuclides were exceeded are shown in Figure 2.4.3.1-3.

Pesticides and Polychlorinated Biphenyls (PCBs). Nine surface soil samples (49 to 53 acceptable analyses were reported) exhibit detectable concentrations of pesticides or PCBs (Table 2.4.3.1-1a). Eight of the samples contain detectable concentrations of the PCB aroclor 1254; one sample contains detectable concentrations of aldrin, heptachlor epoxide, dieldrin, 4,4'-DDT, methoxychlor and endrin ketone; and one sample contains endosulfan-sulfate. Sediment samples did not contain detectable concentrations of pesticides and PCBs. Sample locations where these compounds were detected are shown in Figure 2.4.3.1-4.

Semi-Volatile Organic Compounds. Numerous SVOCs were detected in 44 surface soil samples (19 to 52 acceptable analyses were reported; Table 2.4.3.1-1a). The two sediment samples contained detectable concentrations of semi-volatile compounds. Both samples contain phenanthrene, flouranthene, and pyrene; and one sample also contains benzo(a)anthracene, chrysene, and bis(2-ethylhexyl)phthalate (Table 2.4.3.1-1b). Figure 2.4.3.1-5 gives the locations of these samples.

Volatile Organic Compounds. One sediment sample contained the VOC PCE at a concentration below the detection limit, but the data validation process concluded the result should be included in the data set (Table 2.4.3.1-1b).

General Chemistry Analyses. Surface soil samples collected in IHSS 115 were analyzed for bulk density, particle size, specific conductivity, carbonate, pH and TOC. These parameters were requested by EG&G risk assessment staff for use in the risk assessment and will provide information pertinent to air transport modeling and contaminant mobility. Analytical results for specific conductivity, carbonate, pH, and TOC are included in Appendix B.6. Results for bulk density and particle size are included in Appendix E.

2.4.3.2 Characterization Borings

Soil borings were installed in IHSS 115 for subsurface characterization purposes as part of the OU5 Phase I RFI/RI. These borings were located in IHSS 196 and in the disturbed area east of the landfill (Figure 2.4.3.2-1) in accordance with the OU5 Work Plan (DOE, 1992a).

2.4.3.2.1 Introduction

The soil boring program proposed in the OU5 Work Plan included drilling eight borings, plus a maximum of nine additional borings to be placed within plumes identified by the soil gas survey. Section 2.4.3.3 will discuss the soil borings installed within the plumes. Of the eight borings, six were installed in the disturbed area east of the landfill, and the remaining two were located in IHSS 196, near the locations proposed in the OU5 Work Plan (Figure 2.4.3.2-1). Their exact locations were chosen with the aid of photographic analysis (Section 2.4.1) and the results of the geophysical studies (Section 2.4.2.1).

2.4.3.2.2 Drilling and Sampling Procedures

Hollow-stem augers were used for advancing the boreholes using the techniques described in SOP GT.02. Samples were collected with a split-spoon sampler. Once the drive sampler was removed from the borehole and opened, its contents were scanned with an alpha probe and a beta/gamma probe to detect radioactivity, and an OVM to detect VOCs. The amount of recovered core was then measured, examined visually for the presence of waste material, and the lithology was then logged and classified.

Soil samples were collected continuously from ground surface to the first bedrock interval. Discrete samples were collected in 3-inch stainless steel liners from every 2-foot interval and analyzed for toxic compound list (TCL) VOCs. In addition, 6-foot composite samples were collected and analyzed for TCL SVOCs, TAL metals, total uranium, plutonium, americium, gross alpha, and gross beta, as specified in the OU5 Work Plan (DOE, 1992a). In order to obtain these composite core samples, the recovered core was placed in a safe location, out of direct sunlight, until three consecutive 24-inch, or four consecutive 18-inch samples, totaling the required 6 ft, were collected. Soil samples were then collected from the recovered core, mixed into a 6-foot composite, and placed in appropriate containers for laboratory analysis according to SOP FO.13.

In addition to the discrete samples and the 6-foot composite samples, seven soil samples were collected for geotechnical (i.e., grain size) analyses, as stipulated in the OU5 Work Plan (DOE, 1992a).

2.4.3.2.3 Results

The completed soil boring program for IHSS 115 included the installation of eight soil borings (Figure 2.4.3.2-1). The borings were drilled 6 ft into weathered bedrock, with the exception of boring 50493. Boring 50493, located in the surface disturbance east of the landfill, encountered a sandy interval from approximately 2.7 to 9 ft below the top of bedrock. As a result, this boring was drilled 12 ft into weathered bedrock.

The recovered core was visually logged as the boreholes were advanced and later more closely examined and classified utilizing sieves and other equipment at a designated logging facility, as required in SOP GT.01. The results of this effort indicated that the alluvial material encountered in the boreholes along the top of the ridge in the surface disturbance (50392, 50492, and 50592) ranged from approximately 24 to 27 ft thick (Figure 2.4.3.2-2). The bedrock encountered in boreholes 50392 and 50592 was claystone and silty claystone, respectively. Borehole 50492 encountered clayey siltstone bedrock at an approximate depth of 27 ft. At 31 ft, the clayey siltstone graded to clayey sandstone interbedded with layers of clayey siltstone, silty sandstone, sandy siltstone, and silty claystone to the total depth of the borehole (Figure 2.4.3.2-2).

The boreholes located at the bottom of the ridge in the surface disturbance (50692, 50792, and 50892), encountered alluvial material with thicknesses ranging from approximately 7.5 to 15 ft (Figure 2.4.3.2-3). In addition, borehole 50692 encountered groundwater at a depth of approximately 5.5 ft. The bedrock encountered in these four boreholes consisted of claystone.

Two boreholes, 50992 and 51092, were drilled in the area of IHSS 196 to depths of 12.5 and 6.2 ft, respectively. Both boreholes encountered alluvial material in combination with anthropogenic waste materials, including glass, ceramic, shingles, nails, metal cuttings, and graphite. The bedrock encountered in these two boreholes was described as sandy claystone and sandy siltstone, respectively (Figure 2.4.3.2-4).

Soil samples were collected for geotechnical analysis from each of the boreholes in IHSS 115, except borehole 5059. Appendix E (Figures E1 through E8) presents the results of these analyses. Figures E1 through E5 present the results of the geotechnical samples collected from the boreholes drilled in the surface disturbance east of the landfill, and Figures E6 and E7 show the results for those collected from the two boreholes in IHSS 196. All of the samples collected from these boreholes have been classified as either silty sands/clayey sands (SM/SC) or silty gravels/clayey gravels (GM/GC) using the Unified Soil Classification System (USCS). More specific classifications could not be identified because the USCS does not provide a division between silts and clays from grain size analyses.

As shown on Figure E8 the plots of the results of the samples collected from boreholes 50492, 50692, 50792, and 50892 are very similar, indicating that the material in this area is fairly uniform. The fraction of the sample (expressed as a percent) that is retained by the #4 sieve is classified as gravel using the USCS. Gravel percentages were 35.1, 38.2, 26.9, and 29.7. The fraction of sample passed through the #4 sieve but retained by the #200 sieve is classified as sand using the USCS. Sand percentages were 38.7, 30.2, 31.8, and 26.3. The fraction of the sample that passed the #200 sieve is classified using the USCS as silt or clay. Silt/clay percentages were 26.2, 34.2, 41.3, and 44. Upon examination of these results, the surficial material in this area appeared to be well graded and fairly uniform.

The results of the grain size analysis of the sample collected from borehole 50392 was slightly different from the above borehole samples (Figures E1 and E8). Although this sample has been classified as GM/GC using the USCS, it is much coarser than the above samples. The sample was composed of 75 percent gravel (retained by the #4 sieve), while only 11.2 percent of the sample was silt/clay (passed through the #200 sieve).

Both of the samples from the boreholes located in the IHSS 196 area (50992 and 51092) show a fairly uniform grain size distribution (i.e., they are well graded). Gravel percentages were 32.7 for 50992 and 24.3 for 51092. Sand percentages were 44.2 and 28.9, respectively. Silt/clay percentages were 23.1 and 46.8, respectively.

During the drilling of these boreholes, field monitoring was conducted on the core. The monitoring results from the OVM, the alpha and beta/gamma probes, and radiation smears were at or all below background levels.

Analytical results of the constituents detected at concentrations exceeding BUTLs from the soil samples collected from boreholes 50392 through 51092 are presented on Table 2.4.3.2-1. The analytical results include TAL metals, radionuclides, pesticides, PCBs, SVOCs, and VOCs.

Metals. As presented on Table 2.4.3.2-1 and on Figure 2.4.3.2-5, the metals analyses resulted in the detection of five constituents (barium, copper, lead, manganese, and zinc) at concentrations exceeding BUTLs. A total of 28 acceptable analyses for all metals except lead were performed. There are 13 acceptable analyses of lead. One sample collected from borehole 50592 at 12 to 18 ft contained barium and manganese concentrations (387 and 1540 milligrams per kilogram (mg/kg), respectively) exceeding BUTLs. One sample collected from borehole 50692 at 0 to 6 ft contained a zinc concentration (157 mg/kg) exceeding BUTLs. One sample collected from borehole 50992 at a depth of 0 to 6 ft contained copper and lead concentrations (65.7 and 99.5 mg/kg, respectively) exceeding BUTLs. Although these results are greater than BUTLs, all of the concentrations reported are within the background range with the exception of the lead result from the soil sample collected from borehole 50992.

Table 2.4.3.2-1 indicates that two samples contained copper and zinc concentrations exceeding BUTLs. The previous paragraph discusses an occurrence of greater than background concentrations of each of these metals. The second copper and zinc concentrations detected exceeding BUTLs were from a drum composite soil sample from borehole 50992. This soil sample represented a depth of 0 to 19 ft.

Radionuclides. As shown on Table 2.4.3.2-1 and Figure 2.4.3.2-6, the radiological analyses indicated that four of 28 samples (from boreholes 50492, 50692, and 50992) contained plutonium-239/240 concentrations exceeding the BUTL, two of 28 samples (from boreholes 50692 and 50992) contained americium-241 concentrations exceeding the BUTL, and one of 28 samples (from borehole 50692) having uranium-238 concentrations exceeding the BUTL (Figure 2.4.3.2-6). These samples were collected from a depth of 0 to 6 ft, with the exception of one sample that was collected from a depth of 6 to 12 ft in borehole 50692. The soil sample collected from borehole 50692 at 6 to 12 ft resulted in a plutonium-239/240 concentration equal to the maximum background concentration. Therefore, it appears that all of the radiological contamination detected exceeding maximum background concentrations is in the upper 6 ft of alluvium. Also, the uranium-238 detected in borehole 50692 was within the range of background concentrations.

The summary presented on Table 2.4.3.2-1 also includes the results of a drum composite sample (BH50089AS). The analysis of this sample detected a plutonium-239/240 concentration (0.049 pCi/g) exceeding the BUTL.

Pesticides and Polychlorinated Biphenyls (PCBs). The laboratory analyses performed on the soil samples collected from the surface disturbance east of the landfill did not detect any pesticides or PCBs. The laboratory analyses performed on the soil samples collected from IHSS 196 resulted in the detection of aroclor-1254, aroclor-1260, and alpha-BHC. Aroclor-1254 and aroclor-1260 were detected in a soil sample collected from borehole 50992 from a depth of 0 to 6 ft. These compounds were detected at concentrations of 600 and 910 μg/kg, respectively (detection limit = 160 μg/kg). Also, at borehole 50992, aroclor-1254, aroclor-1260, and alpha-BHC were detected in the soil sample collected from a depth of 6 to 12 ft. These compounds were found at concentrations of 320, 450, and 870 μg/kg, respectively. Also, a drum characterization soil sample, representing depths ranging from 0 to 19 ft, contained aroclor-1254 and aroclor-1260 at concentrations of 870 and 1,300 μg/kg, respectively.

One soil sample collected from borehole 51092 detected only aroclor-1254 at a concentration of 500 μg/kg. Also, a drum characterization soil sample, representing depths ranging from 0 to 12 ft, detected aroclor-1254 at a concentration of 240 μg/kg.

Semi-Volatile Organic Compounds. A variety of semi-volatile constituents were detected in samples from these boreholes (Table 2.4.3.2-1). Benzoic acid was detected at a concentration less than the detection limit (ranging from 190 to 480 μg/kg) in four samples ranging in depth from 6 to 30 ft in borehole 50392. Also, pentachlorophenol was detected in one soil sample from borehole 50392 at a depth of 6 to 12 ft. This constituent was detected at a concentration of 160 μg/kg, which is also below the detection limit.

The results from the soil samples collected at borehole 50492 indicated the presence of benzo(a)anthracene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, fluoranthene, phenanthrene, phenol, and pyrene. These constituents were all detected in a soil sample collected from a depth of 0 to 6 ft, with the exception of bis(2-ethylhexyl)phthalate and phenol. Bis(2-ethylhexyl)phthalate and phenol were detected in a soil sample collected from a depth of 30 to 38 ft. These constituents were all detected at concentrations below the detection limit within the range of 60 to 310 μg/kg.

The results from the soil samples collected at borehole 50692 indicated the presence of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, fluoranthene, and pyrene. These constituents were all detected in a soil sample collected from a depth of 0 to 6 ft, with the exception of 1 bis(2-ethylhexyl)phthalate which was detected in a soil sample collected from a depth of 6 to 12 ft. These constituents were all detected at concentrations below the detection limit within the range of 44 to 81 μg/kg.

The analysis of the soil samples collected at borehole 50892 indicated the presence of benzoic acid. This constituent was detected in all of the samples collected from depths of 0 to 18 ft at concentrations less than the detection limit. The concentrations of benzoic acid ranged from 110 to 214 μg/kg.

The results from the soil samples collected at borehole 50992 indicated the presence of a large number of SVOCs (Table 2.4.3.2-1). These compounds were detected in soil samples collected from depths of 0 to 6 ft and 6 to 12 ft. A number of these constituents were detected at concentrations above and below the detection limit. Also, a drum characterization soil sample, representing depths ranging from 0 to 19 ft, was included as part of this data set. This soil sample also detected a number of SVOCs.

The analysis of soil samples collected at borehole 51092 also indicated the presence of a large number of SVOCs. These compounds however were only detected in soil samples collected from a depth of 0 to 6 ft. Four of these results were at concentrations less than the detection limit, and the remaining results were at concentrations exceeding the detection limit. Also, a drum characterization soil sample, representing depths ranging from 0 to 12 ft, is included as part of the data set presented on Table 2.4.3.2-1. This sample also contained a number of detectable SVOCs.

<u>Volatile Organic Compounds</u>. Table 2.4.3.2-1 presents the VOCs that were present in detectable concentrations. These compounds are TCE, toluene, methylene chloride, PCE, 2-butanone, and acetone.

TCE was detected in boreholes 50392, 50692, and 50892 at concentrations below the detection limit. Toluene was detected in boreholes 50392 through 51092. Nine of the fifty toluene results were at concentrations below the detection limit. The remaining 41 results were within a concentration range of 7 to 220 micrograms per kilogram (μg/kg), with the highest concentration being detected at borehole 50892 at a depth of 12 ft. The detection of toluene in soil samples has been a prevalent occurrence at RFP within the last year. A study conducted under OU6 RFI/RI indicated that the tape being used to seal the sample sleeves contains relatively high toluene concentrations and might be the source of the toluene detected.

Methylene chloride was detected at boreholes 50392 and 50492. Eleven of the 16 methylene chloride results were at concentrations below the detection limit. The remaining five results were detected within a concentration range of 9 to 38 μg/kg, with the highest concentration being detected at borehole 50492 at a depth of 24 ft.

PCE was detected in boreholes 50392, 50892 and 50992. The two PCE results detected in soil samples collected from boreholes 50392 and 50892 were at concentrations below the detection limit. The two PCE results detected in soil samples collected from borehole 50992 were at concentrations of 6 and 9 μg/kg at depths of 4.5 and 2 ft, respectively.

2-butanone was detected only from soil samples collected from borehole 50592. The three results detected were at concentrations of 14, 17, and 69 μg/kg, at depths of 24, 26, and 28 ft, respectively.

Acetone was also detected from soil samples collected from borehole 50592. The five results detected were within a concentration range of 19 to 37 μg/kg, at depths ranging from 2 to 16 ft.

2.4.3.3 Investigation of Soil-Gas Anomalies

Section 2.4.2.2 of this TM presents the results of the soil gas survey at IHSS 115. This section discusses the additional activities conducted to further investigate the anomalies identified by the soil gas survey.

2.4.3.3.1 <u>Introduction</u>

Section 7.2.1 of the OU5 Work Plan (DOE, 1992a) specified that three boreholes be placed at no more than three areas where plumes were identified by the soil-gas survey. The OU5 Work Plan (DOE, 1992a) further specified that at each plume area, one borehole would be placed at the point of the highest soil gas reading, and two boreholes would be placed downslope of that point within the plume. Although Table 7-1 of the OU5 Work Plan (DOE, 1992a) also implied that groundwater monitoring wells be installed within the boreholes drilled at the highest reading within the plume, the text in Section 7.2.1 did not clearly specify the locations of these wells. Therefore, a sampling plan for the soil-gas anomalies, consisting of four borings and two "mini-wells," was developed based on the findings of the soil-gas survey. This plan was detailed in a letter dated May 28, 1993 (Appendix A).

The soil-gas survey consisted of approximately 340 soil-gas points and resulted in the identification of three areas of anomalous concentrations of organic compounds. The first plume, identified as Area A (Figure 2.4.3.3-1), has a surface extent of approximately 2,500 square ft and is located near the center of the landfill, just east of the abandoned storm sewer pipeline, and approximately 80 ft north of the SID. The constituents detected in this area were 1,1,1-TCA and TCE at peak concentrations of 13 μg/L for both organic compounds. This area was not accessible by a truck-mounted drilling rig; therefore, a hydraulic rig mounted on an all-terrain vehicle was employed. This vehicle was used to install two 0.5-inch inside-diameter (ID) polyvinyl chloride (PVC)-cased wells (60993 and 61093) within and downgradient of this plume (Figure 2.4.3.3-1) and to collect soil samples from the boreholes of these wells.

The second plume, identified as Area B (Figure 2.4.3.3-1), has a surface extent of approximately 4,100 square ft and is located west of Area A near the location of IHSS 196. PCE and TCE were detected at this location at peak concentrations of 7.6 and 28 μg/L, respectively. Three borings, 58393, 58493, and 58593, were installed within this plume at locations where the highest soil gas readings were taken (Figure 2.4.3.3-1).

The third plume, identified as Area C (Figure 2.4.3.3-1), has a surface extent of approximately 460 square ft and is located southwest of Area B near the location of IHSS 196. PCE was detected within this area at a peak concentration of 1.2 μg/L. Only one boring, 58693, was installed at this location due to the relatively small size of the plume. This boring was installed at the location of the highest soil gas reading (Figure 2.4.3.3-1). Groundwater was encountered at this boring at approximately 12 ft. The Hydropunch II® one-time groundwater sampling system was used to collect a sample of the groundwater.

2.4.3.3.2 Drilling and Sampling Procedures

Hollow-stem augers were used for advancing the boreholes using the techniques described in SOP GT.02. Samples were collected with a split-spoon sampler. Once the drive sampler was removed from the borehole and opened, its contents were scanned with an alpha and beta/gamma probe to detect radioactivity, and an OVM to detect VOCs. The amount of recovered core was then measured, examined visually for the presence of waste material, and the lithology was logged and classified.

Soil samples were collected continuously from ground surface to the first bedrock interval. Discrete samples were collected in 3-inch stainless steel liners from every 2-foot interval and analyzed for TCL VOCs. Six-foot composite samples were collected and analyzed for TAL metals, TCL SVOCs, total uranium, plutonium, americium, gross alpha, and gross beta. In order to obtain these composite core samples, the recovered core was placed in a safe location, out of direct sunlight, until three consecutive 24-inch, or four consecutive 18-inch samples, totaling the required 6 ft, were collected. Soil samples were then collected from the recovered core, mixed into a 6-foot composite, and placed in appropriate containers for laboratory analysis according to SOP FO.13.

In addition to the discrete samples and the 6-foot composite samples, 2-foot composite samples were collected from the top 2 ft of boreholes 58493, 58593, and 58693 to be used in the ecological assessment study. These samples were analyzed for the same constituents as listed above, with the exception of VOCs.

As discussed in the previous section, a one-time groundwater sample was collected from borehole 58693. This sample was collected using the Hydropunch II® groundwater sampler in accordance with DCN 93.03 to SOP GW.06. This groundwater sample was analyzed for gross alpha, gross beta, total uranium, TAL metals, and VOCs. In addition, pH, specific conductance, temperature, and dissolved oxygen were measured in the field at the time of sample collection in accordance with SOP GW.05.

2.4.3.3.3 Well Installation and Sampling Procedures

Mini-wells 60993 and 61093, located in plume A, were installed after hydraulically driving a Kansas Sampler (a solid core barrel) into the soil in accordance with DCN 93.03 to SOP GT.02.

With this technique, soil samples were collected in a stainless steel liner located inside the barrel. Once the core barrel was removed from the borehole and the soil was extracted, the soil was scanned with an alpha probe, a beta/gamma probe, and an OVM, and the amount of recovery was measured.

Soil samples were collected from ground surface to the first bedrock interval. Discrete samples were collected in 6-inch stainless steel liners from every 2-foot interval above bedrock and analyzed for TCL VOCs. Six-foot composite samples were also collected, in the same manner as described in Section 2.4.3.3.2, and analyzed for TAL metals, TCL SVOCs, total uranium, plutonium, americium, gross alpha, and gross beta.

Following the completion of the borings, 0.5-inch ID PVC wells were installed in accordance with DCN 93 to SOP GT.06. These wells were constructed inside a 1-3/8-inch open hole. The bottom of the screened intervals were located approximately 4 ft below the bedrock contact. Well 60993 was installed with a 5-foot screen and well 61093 was installed with a 10-foot screen (Figure 2.4.3.3-2). Silica sand was installed within the annulus between the borehole and the screen from the bottom of the boring to approximately 2 ft above the top of the screened interval. Each well was then completed by filling the remaining annulus with concrete; installing a steel, locking, protective casing; and constructing a 3- by 3-foot concrete pad around the protective casing.

Well 60993 was dry. Well 61093 was developed and sampled in accordance with SOP GW.05 and SOP GW.06. The results of the analysis of the samples from well 61093 are presented in Section 2.4.4.2.

A well point, 60893, was also installed near borehole 58693. This well point was sampled once, and water levels were measured in this well point for several month following its installation. Analytical results for the groundwater sample from this well point are discussed in Section 2.4.4.2.

2.4.3.3.4 Results

The completed soil boring program for the investigation of the soil gas anomalies included the installation of four soil borings (58393, 58493, 58593, and 58693) and two mini-wells (60993 and 61093) in accordance with the sampling plan for the soil-gas anomalies (EG&G, 1993d) (Figure 2.4.3.3-1). Boreholes 58493 and 58593 were drilled a minimum of 5 ft into weathered bedrock as proposed in the OU5 Work Plan (DOE, 1992a). Boreholes 58393 and 58693 were only drilled 4 ft into bedrock, because the split-spoon sampler had reached refusal (greater than 100 blowcounts per 6 inches). The mini-wells installed in Area A penetrated 4 ft into bedrock.

The recovered core from boreholes 58393 - 58693 was visually logged as the boreholes were advanced in accordance with SOP GT.01. It was later more closely examined and classified utilizing sieves and other equipment at a designated logging facility as required in SOP GT.01. The results of this effort indicated that bedrock consisting of claystone was encountered in the boreholes at depths ranging from 9.4 to 27 ft (Figure 2.4.3.3-2). The material above bedrock appeared to be alluvial material interbedded with landfill debris. The landfill debris occurred in a zone ranging from 0 to 2.5 ft to depths of approximately 8.5 to 15.5 ft in boreholes 58393, 58493, and 58693. Borehole 58593 encountered alluvial material with landfill debris occurring from a depth of approximately 3 to 4 ft and then again from a depth of from approximately 6 to 6.5 ft.

The boreholes drilled for the mini-wells (60993 and 61093) encountered bedrock consisting of claystone at 5.5 and 9 ft, respectively. Since all core was required for analytical samples, core from these boreholes was logged only in the field. The alluvial material, consisting of Rocky Flats Alluvium, contained no landfill debris (Figure 2.4.3.3-3).

During the drilling of these boreholes and wells, field monitoring, as described in the previous section, was conducted on the core. The monitoring results from the OVM, the alpha and beta/gamma probes, and radiation smears were below background levels at all locations except borehole 58393. At borehole 58393, the OVM readings were 1 ppm from the soil in the interval from 2 to 4 ft, and 3 ppm from the soil in the interval from a depth of 4 to 6 ft.

Analytical results of the constituents detected at concentrations exceeding BUTLs from the soil samples collected from boreholes 58393, 58493, 58593, and 58693, and mini-wells 60993 and 61093 are presented on Table 2.4.3.3-1. The analytical results include TAL metals, radionuclides, pesticides, PCBs, SVOCs, and VOCs.

Metals. As presented on Table 2.4.3.3-1 and shown on Figure 2.4.3.2-5, the metals analyses resulted in the detection of eight constituents (cadmium, chromium, copper, iron, lead, molybdenum, nickel, and zinc) having concentrations exceeding BUTLs. Cadmium was detected in two of 17 samples, which were collected at depths of 0 to 6 ft and 6 to 12 ft from boreholes 58593 and 58493, respectively. The analytical results for these samples indicated concentrations that are within the background range of concentrations.

Chromium was detected in two of 17 samples at a depth of 6 to 12 ft from boreholes 58393 and 58493. The results for these samples indicated concentrations within the background range of concentrations.

Five of 17 samples contained copper concentrations exceeding the BUTL but within the background range of concentrations. Two samples contained copper concentrations greater than the maximum background concentration at levels of 361 and 749 mg/kg. These results were from soil samples collected from boreholes 58393 and 58493, respectively, at a depth of 6 to 12 ft.

Iron was detected in one of 17 samples at a concentration of 49,500 mg/kg, which exceeds both the BUTL and the maximum background concentration. This sample was collected from borehole 58693 at a depth of 6 to 12 ft.

Lead was detected in one of 3 samples at a concentration of 80.2 mg/kg, which exceeds both the BUTL and the maximum background concentration. This sample was collected from borehole 58593 at a depth of 0 to 6 ft.

Molybdenum was detected in one of 16 analyses at a concentration of 190 mg/kg, which exceeds both the BUTL and the maximum background concentration. This sample was collected from borehole 58493 at a depth of 6 to 12 ft.

Nickel was detected in three of 17 analyses at a depth 6 to 12 ft from boreholes 58393, 58493, and 61093. The analytical results for these samples indicated concentrations within the background range of concentrations.

Four of 17 analyses indicated zinc concentrations greater than the BUTL but within the range of background concentrations. Two analyses detected zinc at concentrations exceeding the maximum background concentrations at levels of 502 and 648 mg/kg. These results were from soil samples collected from boreholes 58493 and 58393, respectively, at a depth of 6 to 12 ft.

In summary, copper, iron, lead, molybdenum, and zinc were the only constituents that exceeded both BUTLs and maximum background concentrations. The concentrations of these constituents were within the same order of magnitude as the maximum background concentrations, and as such, they do not appear to be at exceedingly high concentrations. Also, these constituents were found at the depth of 6 to 12 ft, with the exception of lead, which was found at a depth of 0 to 6 ft (Figure 2.4.3.2-5).

Radionuclides. As shown on Table 2.4.3.3-1 and on Figure 2.4.3.2-6, 13 samples from these boreholes were analyzed for radionuclides. The radiological analyses identified seven samples (from boreholes 58393, 58493, 58593, and 58693) having plutonium-239/240 concentrations exceeding the BUTL with concentrations ranging from 0.053 to 3.2 pCi/g. Three samples (collected from boreholes 58393 and 58493) had americium-241 concentrations exceeding the BUTL, ranging from 0.023 to 0.46 pCi/g. Four samples from boreholes 58393, 58493, and 58693 had uranium-235 and uranium-238 concentrations exceeding BUTLs, ranging from 0.21 to 2.3 pCi/g and 1.8 to 12 pCi/g, respectively. Three samples from boreholes 58393 and 58493 had uranium-233/234 concentrations exceeding the BUTL, ranging from 9.1 to 30 pCi/g.

As shown on Figure 2.4.3.2-6, all of these samples were collected from depths of 0 to 6 ft and 6 to 12 ft, with the exception of two samples that were collected from borehole 58693. One of these samples was collected from a depth 12 to 19.5 ft, and one was collected from a depth of 25.5 to 29.5 ft. The maximum concentration of each of the above constituents was detected from the soil sample collected from borehole 58493 at a depth of 6 to 12 ft. Only one of the above constituents detected exceeding BUTLs (uranium-238 from borehole 58493 at a depth of 0 to 6 ft), was detected at a concentration below the maximum background concentration. All other results exceeded both BUTLs and maximum background concentrations.

Pesticides and Polychlorinated Biphenyls (PCBs). The laboratory analyses performed on the soil samples collected from plume A resulted in the detection of aroclor-1254 at a concentration of 860 μg/kg (Table 2.4.3.3-1). This compound was detected in a sample collected from a depth of 6 to 13 ft.

The laboratory analyses performed on the soil samples collected from plume B resulted in the detection of aroclor-1254 (Table 2.4.3.3-1). This compound was detected in soil samples collected from boreholes 58393 and 58493 at depths of 6 to 12 ft and 0 to 6 ft, respectively. At borehole 58393, aroclor-1254 was detected at a concentration of 440 μg/kg. At borehole 58493 aroclor-1254 was detected at a concentration of 210 μg/kg.

The laboratory analyses performed on the soil samples collected from plume C (58693), resulted in the detection of heptachlor epoxide at a concentration of 11 μg/kg (Table 2.4.3.3-1). This compound was detected in the soil sample collected from a depth of 6 to 12 ft.

Semi-Volatile Organic Compounds. A variety of SVOCs were detected at concentrations that either exceeded the detection limit, or indicated the presence of that compound, but was reported below the detection limit (Table 2.4.3.3-1).

SVOCs were not detected in the soil samples collected from the boreholes where wells 60993 and 61093 were installed (boreholes installed within plume A).

The soil samples collected from boreholes 58393, 58493 and 58593 (boreholes installed within plume B) detected 2-methylnaphthalene, acenaphthene, anthracene, benzoic acid, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, butylbenzylphthalate, chrysene, dibenzofuran, di-n-butylphthalate, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, isophorone, naphthalene, phenanthrene, pyrene, and bis(2-ethylhexyl)phthalate. The majority of these constituents were detected at concentrations below the detection limit. The only constituents that were detected exceeding the detection limit were benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, fluoranthene, phenanthrene, and pyrene. These constituents were detected in soil samples collected at boreholes 58393 (from a depth range of 0 to 12 ft) and 58493 (from a depth range of 0 to 6 ft).

The soil samples that were collected from borehole 58693 (borehole installed within plume C) detected 2-methylnaphthalene, acenaphthene, anthracene, benzoic acid, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, dibenzofuran, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene. About half of these constituents were detected at concentrations below the detection limit. These constituents were detected in soil samples collected from a depth range of 0 to 29.5 ft at concentrations ranging from 41 to 4100 μg/kg. Phenanthrene was the constituent that was detected at both the low and the high concentration value. The samples in which phenanthrene was detected were collected from a depth of 12 ft to 19.5 ft (4,100 μg/kg) and 25.5 ft to 29.5 ft (41 μg/kg).

Volatile Organic Compounds. Table 2.4.3.3-1 summarizes the results for detected VOCs. As presented on this table, the compounds that were detected in this area are TCE, toluene, methylene chloride, PCE, 2-butanone, acetone, 1,1,1-TCA, and 4-methyl-2-pentanone.

The boreholes/wells that were installed within plume A, where 1,1,1-TCA and TCE were detected by the soil gas survey, included mini-wells 60993 and 61093. The laboratory analyses performed on the soil samples collected from borehole 60993 detected 1,1,1-TCA, 4-methyl-2-

pentanone, acetone, and TCE. At a depth of 4 ft, acetone was detected at a concentration of 32 μg/kg, but it was also detected in the blank. At a depth of 6 ft, acetone and TCE were detected at concentrations of 17 and 7 μg/kg, respectively (acetone was also detected in the lab blank). At a depth of 8 ft, 1,1,1-TCA, 4-methyl-2-pentanone, acetone, and TCE were detected at concentrations of 2, 2, 29, and 20 μg/kg, respectively (acetone was also detected in the lab blanks, and 1,1,1-TCA and 4-methyl-2-pentanone were detected at concentrations below the detection limit).

The laboratory analyses performed on the soil samples collected from borehole 61093 detected acetone, TCE, and 2-butanone. Acetone was detected at depths of 4, 6, 8, 10, and 13 ft at concentrations of 28, 48, 26, 34, and 359 μg/kg, respectively. Acetone was also detected in the lab blanks for each of these samples. TCE was detected at depths of 10 and 13 ft at estimated concentrations of 1 and 2 μg/kg, respectively (below detection limits). 2-butanone was detected at a depth of 13 ft at an estimated concentration of 17 μg/kg (below detection limit).

Three boreholes, 58393, 58493, and 58593, were installed within plume B, where PCE and TCE were detected by the soil gas survey. Samples from borehole 58393 contained PCE and TCE at concentrations of 100 and 110 μg/kg, respectively, from a depth of 10.5 ft. Borehole 58493 contained acetone, methylene chloride, PCE, toluene, and TCE at a depth of 3 ft. Acetone and methylene chloride, which were detected at concentrations of 27 and 14 μg/kg, respectively, were also detected in the lab blanks. Toluene was detected at 4 μg/kg, a concentration below the detection limit. The remaining constituents, PCE and TCE, were detected at concentrations of 110 and 7 μg/kg, respectively. PCE and TCE were also detected in soil samples collected from this borehole at a depth of 9.5 ft. PCE was detected at a concentration of 10 μg/kg, but TCE was detected below the detection limit at an estimated concentration of 2 μg/kg. The soil samples collected from borehole 58593 detected PCE at a depth of 3 ft, and PCE and TCE at a depth of 5 ft. The PCE that was detected in the 3-foot interval was at an estimated concentration of 2 μg/kg, which is below the detection limit. The PCE and TCE that was detected in the 5-foot interval, were at concentrations of 250 and 28 μg/kg, respectively.

Borehole 58693 was installed within plume C. PCE was the only constituent detected at this location by the soil gas survey. The laboratory analyses that were performed on the soil samples that were collected from this borehole detected acetone, PCE, TCE, and toluene. PCE, TCE, and toluene were detected at concentrations below the detection limit (estimated at 3, 2, and 3 μg/kg, respectively). PCE and TCE were both detected at a depth of 17 ft and toluene was detected at a depth of 7 ft. Acetone was detected at a concentration of 36 μg/kg at a depth of 3 ft. PCE and acetone were detected at concentrations of 10 and 42 μg/kg, respectively at a depth of 7 ft.

Also, during the drilling of borehole 58693, (plume C) groundwater was encountered, and a groundwater sample was collected using the Hydropunch II system®. Table 2.4.3.3-2 lists those constituents that were detected in this sample at concentrations that exceeded BUTLs. The laboratory analyses of this sample indicated that there were no radionuclide constituents detected at concentrations exceeding BUTLS. Also, these results indicated that there were no SVOCs, pesticides, or PCBs detected. There were, however, a suite of metals detected at concentrations exceeding BUTLs. As presented on Table 2.4.3.3-2, these constituents include arsenic, mercury, aluminum, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, magnesium, manganese, nickel, potassium, vanadium, zinc, strontium, silicon, and lithium. All of these constituents, with the exception of lithium, were detected at concentrations that also exceeded the maximum background concentrations. The analytical results of this groundwater sample also detected one VOC, PCE. PCE was detected at a concentration of 16 μg/L. PCE was the only VOC detected at this location by the soil gas survey.

In summary, the soil and groundwater samples collected during drilling from the boreholes within the anomalies identified by the soil gas survey confirmed the results of the soil gas survey. The VOCs detected by the soil gas survey at each location were also detected in the soil and groundwater samples.

2.4.3.4 Surface-Water and Sediment Sampling

The Phase I FSP outlined by the OU5 Work Plan specified the collection of surface-water and sediment samples from throughout the Woman Creek drainage. Although the Work Plan called for this sampling program under Stage 3 of the IHSS 115 investigation, the samples collected were to provide data applicable to the other OU5 IHSSs. TM1 (EG&G, 1993a, as amended) was prepared to summarize existing data collected under other programs and to define a revised surface-water and sediment sampling program for OU5.

This section discusses the results of the sampling conducted in Woman Creek and the SID. Section 2.6.2 discusses the sampling program implemented at Pond C-1 (IHSS 142.10) and Pond C-2 (IHSS 142.11). Section 2.7.3.1 describes surface-water and sediment sampling activities at IHSS 209 and the other surface disturbances.

2.4.3.4.1 <u>Introduction</u>

Hydrologic components of the OU5 revised FSP are given in TM1 and include aspects of both surface-water (SW) and sediment (SED) sample collection from Woman Creek and the SID. The specific SW and SED sites used for evaluation of additional data collected in accordance with guidelines in TM1 are indicated on Figure 2.4.3.4-1; these sites are described in Table 2.4.3.4-1. Samples were to be collected during two scheduled quarterly baseflow, and two storm-event (that is, high-flow) stream conditions. Table 2.4.3.4-1 provides a listing of the monitoring-site location codes, type of monitoring site, purpose, sampling frequency, and equipment at the site. These 17 non-pond surface-water monitoring sites included in sampling surveys were as given in Tables 2.4.3.4-1 and 2.4.3.4-2, along with the nine stream-channel (non-pond) bottom-sediment sampling sites.

These designated monitoring sites are located in the stream thalweg along Woman Creek, Antelope Spring Creek, and the SID with the following exceptions. Monitoring sites SW50193 and SW50293 are located adjacent to Woman Creek and were added to the OU5 FSP after the November 1992 quarterly base-flow sampling survey, in order to characterize seep water before it enters Woman Creek from the north and south sides of the stream, respectively (Figure 2.4.3.4-1. Sites IHSS209 and SW55193 were designated to sample waters impacted by the disturbed area in IHSS 209 (Figure 2.4.3.4-1). Finally, site SW500 samples flows from the storm-sewer discharge into the SID (Figure 2.4.3.4-1).

The OU5 FSP specified the chemical-analytical schedule and Microtox/acute-toxicity Surface-Water Toxicity Monitoring Program collaboration for samples collected at each monitoring site (EG&G, 1994a, Table 10); this schedule is also given in Table 2.4.3.4-3. The non-pond stream/ditch and associated bottom-sediment samples were analyzed for four general categories of chemical constituents: radionuclides, TAL metals, miscellaneous water-quality variables, and VOCs, as well as for Microtox/acute toxicity.

2.4.3.4.2 Sampling Procedures

The one-time bottom-sediment sampling survey at all nine OU5-FSP monitoring sites were collected on November 5, 1992. These samples were processed for the required analyses as outlined in Table 2.4.3.4-3. Toxicity analyses were made on two samples (sites SED127 and SED501; an additional sample was collected at site SED506 on November 9, 1992 for toxicity analyses only (EG&G, 1994a, Table 9). Some difficulty in obtaining an adequate volume of sediments was encountered at many sampling locations, due to rocks and cobbles present in the stream bottom. Nonetheless, adequate volumes ultimately were obtained. The sample numbers associated with the nine sediment samples collected on November 5, 1992 ranged from SD50001WC to SD50012WC, with SD50007WC representing a duplicate quality-control sample associated with site SED507 (EG&G, 1994a, Appendix J). Sample number SD50022WC identified the supplemental toxicity sample collected at monitoring site SED506 on November 9, 1992 (Table 2.4.3.4-4).

Quarterly base-flow surface-water samples were collected at eight of the 12 monitoring sites on November 4, 1992. During this initial base-flow survey, no samples were collected at sites SW027 and SW507, both located on the SID, nor at sites SW041 and SW127, both on the south tributary of Woman Creek, due to insufficient water in the streams at the time of the November 4, 1992, survey. The samples were processed for the required analyses as outlined in Table 2.4.3.4-3. The sample numbers associated with the eight surface-water base-flow samples are SW50213WC and SW50216WC through SW50224WC, with samples SW50217WC and SW50218WC constituting quality-control samples (rinsate and duplicate, respectively) associated with site SW029 (EG&G, 1993j, Appendix J). Toxicity samples were collected during this initial base-flow survey at the following four monitoring sites (Table 2.4.3.4-4): SW040, SW033, SW034, and SW026 (Figure 2.4.3.4-1). Sites SW027 (SID) and SW041 (south branch of Woman Creek, Figure 2.4.3.4-1) were dry, and therefore, no toxicity samples that were originally scheduled could be collected during this survey.

The second quarterly base-flow surface-water samples were collected at 13 of the 14 designated monitoring sites on March 24, 1993. Also, sites SW50193 and SW50293 were added to the original 12 sites after the November 1992 sampling survey. No sample was collected at monitoring site SW027 along the SID, due to insufficient water in the ditch at the time of this survey. The resultant samples were processed for the specified analyses as outlined in Table 2.4.3.4-3. The sample numbers associated with the 13 stream/ditch base-flow samples are SW50201JE, and SW50203JE through SW50216JE, with samples SW50212JE and SW50213JE constituting quality-control samples (rinsate and duplicate, respectively) associated with site SW040 (EG&G, 1993j, Appendix J). During the March 24, 1993 survey, toxicity samples were collected at the following four monitoring sites (Table 2.4.3.4-1): SW127, SW041, SW50193, and SW50293. These all represented sites not included in the November 1992 sampling survey. No toxicity sample was collected from site SW027 (at the lower reach of the SID) during either base-flow sampling survey, as originally scheduled, due to lack of flowing water.

High-flow surface-water samples were collected at two of the 14 designated sampling sites on March 29, 1993 (Table 2.4.3.4-4). Both monitoring sites (SW507 and SW027) for this survey were located along the SID (Figure 2.4.3.4-1). The sample numbers associated with these high-flow samples were SW50217JE and SW50218JE, with SW50219JE and SW50220JE constituting quality-control samples (rinsate and duplicate, respectively) associated with site SW027 (EG&G, 1994a, Appendix J). A second high-flow surface-water sampling took place on May 17, 1993, with samples collected at the same two of 14 sites (SW507 and SW027), as described above. The sample numbers associated with these high-flow samples are SW50221JE and SW50222JE, with SW50223JE and SW50224JE constituting quality-control samples (rinsate and duplicate, respectively) associated with site SW027 (EG&G, 1993j, Appendix J). No other synoptic non-pond surface-water samples were collected during either of these high-flow events. A high-flow sampling also took place during April 1994. No results are available yet for this sampling event.

2.4.3.4.3 Results

The available analytical results were obtained from the RFEDS in retrievals dated August 5, 1993 (EG&G, 1993j) and January 28, 1994 (EG&G, 1994a, Appendix J). This latter retrieval served to fill in the few missing data from the earlier retrieval (EG&G, 1994a, Table 2D) as well as update, as appropriate, data files for the Hydrologic Data Summary (EG&G, 1994a). Based on the analyses specified in the OU5 FSP, all laboratory data were received for the four general categories of chemical constituents (radionuclides, TAL metals, miscellaneous water-quality variables, and VOCs); results are provided in EG&G (1994a, Appendix Tables J-1 through J-4, respectively). For surface-water sites, the TAL metals include a total of 29 chemical constituents: 24 trace metals, four major cations (calcium, magnesium, potassium, and sodium), and silicon. For sediment sites, the TAL metals include 28 chemical constituents: the above constituents less silicon (EG&G, 1994a, Appendix Table J-2). The miscellaneous water-quality variables include major anions (bicarbonate, carbonate, sulfate, and chloride), fluoride, nitrite-plus-nitrate nitrogen, (total) dissolved solids, total suspended solids, dissolved organic carbon, TOC, and infrequent other analyses (EG&G, 1994a, Appendix Table J-3). The OU5-FSP surface-water sample-analyses summary status is provided in Table 2.4.3.4-4.

In collaboration with the OU5-FSP low-flow investigations, Micro- and acute-toxicity tests were conducted on samples collected at ten surface-water sites and at three non-pond sediment sites (Tables 2.4.3.4-3 and 2.4.3.4-4). Details of the sampling surveys and associated analyses are documented by The Seacrest Group (1992, 1993a, 1993b). Microtox/acute toxicity test results have been summarized in EG&G (1994a, Table 9).

In comparing historical RFEDS data (EG&G, 1994a, Appendix Tables G-1 and G-2) with the more recent OU5-FSP-generated data (EG&G, 1994a, Appendix J, Figures 8A-M, 9A-M, and 10A-J, and Table 8), the following observations were noted (also see EG&G, 1994a, Table 13):

- In many cases, especially radionuclides, concentrations of dissolved constituents were higher than concentrations of total constituents. The reverse pattern (that is, total concentrations higher than dissolved concentrations) would be expected. Both radionuclide and trace-metal concentrations were often near detection limits, which may contribute to this anomaly.

- Recent trace-metals concentrations (based upon the OU5-FSP data) frequently are lower compared to earlier RFEDS data; however, in many cases, this comparative observation may be attributable to generally lower analytical detections limits applicable to the more recent data.

- In general, the concentrations of both surface-water and bottom-sediment constituents were below background BUTLs (EG&G, 1993i) for similar media at RFP.

Stream-reach profiles of Woman Creek for selected water-quality constituents are plotted from upstream (RFP west boundary) to downstream (below Pond C-2) as shown on Figures 2.4.3.4-2, 2.4.3.4-3, 2.4.3.4-4, and 2.4.3.4-5 for the low-flow surveys performed on November 4, 1992 and March 24, 1993. The purpose of these stream-reach water-quality profiles was to attempt to obtain cause-and-effect relationships between water quality and IHSS locations within OU5. The locations of selected IHSS and tributary inflow locations on Woman Creek downstream from the RFP west boundary are indicated at the top of each figure for reference.

Radionuclides. Selected radionuclide (gross-alpha, gross-beta, plutonium-239/240, uranium-233/234, uranium-235, uranium-238, americium-241, cesium-137, and strontium-89/90) concentrations (total and dissolved) are plotted on Figures 2.4.3.4-2A through 2I for the low-flow survey on November 4, 1992, along with the BUTL (EG&G, 1993i) for each constituent.

Analysis of these stream-reach water-quality profiles indicates that, while both total and dissolved concentrations generally increase downstream in Woman Creek, none of the concentrations are greater than the BUTLs (EG&G, 1993i). For some constituents, such as uranium species, it appears that Antelope Spring Creek may be a contributor to increased downstream concentrations.

The same radionuclide constituents are shown on Figures 2.4.3.4-3A through 3H for the low-flow sampling survey on March 24, 1993. Analysis of these profiles indicates the same basic trend of increased concentrations in the downstream direction in Woman Creek as observed during the low-flow survey on November 4, 1992. Except for one total plutonium-239/240 concentration of 0.031 pCi/L downstream from Pond C-1 (EG&G, 1994a, Figure 9C), other concentrations were less than the BUTL (EG&G, 1993i). This one plutonium-239/240 concentration was higher than background (0.02 pCi/L) by 55 percent. This one value, apparently isolated, should not be used to conclude that plutonium-239/240 is a contaminant of concern in Woman Creek. No definite conclusions regarding the cause and/or effect of IHSS or tributary inflow contributions to the general downstream concentration increases of radionuclides in Woman Creek can be drawn for the data collected during the low-flow survey on March 24, 1993.

Trace-Metals. Selected total and dissolved trace-metal (iron, manganese, and strontium) concentrations for Woman Creek stream-reach profiles are plotted on Figures 2.4.3.4-2K through 2M for the November 4, 1992 low-flow survey and on Figures 2.4.3.4-3K through 3M for the March 24, 1993 low-flow survey. Iron and manganese concentrations for both low-flow surveys show elevated values at the RFP west boundary which return to near detection levels until just downstream from Pond C-1 where these concentrations increase and then decrease again to near detection. Both iron and manganese concentrations in Woman Creek are well below the specified BUTLs (EG&G, 1993i) for these constituents in RFP surface waters.

Both total and dissolved strontium shows a consistent pattern of increase in the downstream direction in Woman Creek for both the low-flow surveys. These strontium concentrations are below the BUTLs (EG&G, 1993i) for both total and dissolved constituents. The general increase downstream may be due to combinations of seeps and other tributary inflows from IHSS areas and Antelope Spring Creek, which show strontium concentrations higher than Woman Creek at the RFP west boundary.

Other Water-Quality Constituents. Other water-quality constituent (calcium, magnesium, potassium, sodium, bicarbonate, sulfate, chloride, total dissolved solids, total suspended solids, and silicon) concentration stream-reach profiles for Woman Creek are shown on Figures 2.4.3.4-4A through 4J for both the November 1992 and March 1993 low-flow surveys. Analysis of these stream-reach water-quality profiles indicates that the water-quality constituents generally increase in concentration in the downstream direction in Woman Creek for both of these low-flow surveys. Concentrations of calcium, magnesium, sodium, and sulfate were greater than the BUTLs (EG&G, 1993i) for these constituents downstream from Pond C-1. The maximum increase above background for the above cations and anions was approximately 28 percent, which is still considered to be well within the typical range of these water-quality constituents.

Stiff diagrams were calculated using major-ion analyses for the seven water-quality sites on Woman Creek for both the November 1992 and March 1993 low-flow sampling surveys (EG&G, 1994a, Appendix Figures J-1 and J-2). The purpose of the Stiff diagrams was to assess if changes in water type were occurring in the downstream direction in Woman Creek or if changes had occurred between the November 1992 and March 1993 low-flow surveys. Results of the Stiff-diagram analyses indicate that the low-flow water type in Woman Creek is a calcium-bicarbonate type, which does not vary in the downstream direction for both the November 1992 and March 1993 low-flow sampling surveys. Ion and dissolved solids balances also are shown in EG&G (1994a, Appendix Figures J-1 and J-2) and are acceptable for the water-quality data available for both low-flow surveys.

Organic Constituents. Total and dissolved organic carbon concentrations were used as an indicator for organic contaminants for stream-reach profiles in Woman Creek. The November 4, 1992 low-flow survey results are shown on Figure 2.4.3.4-2J and the March 24, 1993 low-flow survey results are shown on Figure 2.4.3.4-3J. Analysis of these profiles indicates that organic carbon concentrations in Woman Creek are generally well below the BUTLs for RFP (EG&G, 1993i). One value of dissolved organic carbon (21 mg/L), measured downstream from Pond C-2 (Figure 2.4.3.4-3J) during the March 24, 1993 low-flow survey, was above background concentration (17.0 mg/L). The cause for this increase (19 percent) above background is unknown. There appears to be a consistent increase in organic carbon concentrations downstream from Pond C-1, perhaps caused by releases from Pond C-1. It does not appear, based upon results of the two FSP-related low-flow surveys, that contributions of organic carbon are coming from IHSSs other than Pond C-1, and that these impoundment-related contributions are very small.

Table 2.4.3.4-5 summarizes the number of water-quality constituents for TAL metals, radionuclides, and water-quality variables which had concentrations higher than BUTLs in surface-water samples. Table 2.4.3.4-5 also summarizes VOCs which were detected in water samples from mainstem Woman Creek and selected tributaries.

Stream-reach profiles of Woman Creek for selected bottom-sediment constituents are plotted from upstream (RFP west boundary) to downstream (below Pond C-2) as shown on Figures 2.4.3.4-5A through 5M for the low-flow surveys performed on November 4, 1992 and March 24, 1993. As with the water-quality steam-reach profiles, the purpose of the bottom-sediment stream-reach profiles was to attempt to obtain cause-and-effect relationships between sediment quality and IHSS locations within OU5. The locations of selected IHSS and tributary inflow locations on Woman Creek downstream from the RFP west boundary are indicated at the top of each figure for reference.

Radionuclides. Selected radionuclide (gross-alpha, gross-beta, plutonium-239/240, americium-241, and tritium) concentrations are plotted on Figures 2.4.3.4-A through E for the one-time sediment sampling of November 5-10, 1993, along with the appropriate stream-sediment BUTL (EG&G, 1993i) for each constituent. These stream-reach sediment-quality profiles indicate that none of the samples had concentrations higher than the corresponding BUTLs and that the concentrations of radionuclides generally were higher in the sediments within Pond C-1, with the exception of tritium, which is non-sorbing. This is to be expected, because Pond C-1 is on-channel and reduces the potential for sediment transport downstream.

Trace-Metals. Selected trace-metals (aluminum, arsenic, barium, iron, lead, manganese, nickel, and vanadium) sediment-concentration profiles are shown on Figures 2.4.3.4-F through M for the sampling of November 5-10, 1993 . As with the radionuclides, trace-metal concentrations generally increased downstream from the RFP west boundary and were highest within Pond C-1. These concentrations then decrease downstream. Mercury concentrations were shown to be higher than the mercury BUTL (EG&G, 1993i) for sediments within Pond C-1 (see Section 2.6.2.1.3). Table 2.4.3.4-6 summarizes the sediment-quality constituents which had trace-metal concentrations higher than BUTLs (EG&G, 1993i) for all samples collected for the FSP one-time sediment sampling. Based upon the data in Table 2.4.3.4-6, barium, cadmium, copper, silver, and zinc also had concentrations higher than respective BUTLs for one or more locations within OU5 during the November 5-10, 1993 sampling survey.

Other Water-Quality Constituents. Other water-quality constituent (calcium, magnesium, potassium, sodium, nitrite/nitrate, and TOC) concentrations were analyzed for sediment samples collected during the November 5-10, 1993 sampling. As shown in Table 2.4.3.4-6, calcium and TOC both had concentrations higher than BUTL (EG&G, 1993i) at two and three sites within OU5, respectively.

Organic Constituents. No organic constituents were analyzed for stream-sediment sampling sites. These sites were only in the C-Ponds.

2.4.4 Stage 4

Stage 4 activities conducted at IHSSs 115 and 196 consisted of a CPT program and the investigation of groundwater quality through the use of well points and monitoring wells. The implementation and results of these activities are discussed in this section.

2.4.4.1 Cone Penetrometer Testing

Performance of CPT was proposed in the OU5 Work Plan as part of Stage 4 activities of the Phase I RFI/RI of IHSS 115. The Work Plan also specified that a TM be prepared outlining the details of the cone penetrometer use, type of sampler, and spacing of test locations. The details of the CPT program implemented at IHSS 115 and the results obtained are discussed in the following subsections.

2.4.4.1.1 Introduction

TM6 was prepared based upon evaluation of work conducted during Stages 1, 2, and 3 and provides specifics of the proposed CPT program. CPT provides a way to rapidly measure soil parameters such as tip resistance, local friction, and pore pressure. The overall purpose of the CPT sampling program as stated in both the OU5 Work Plan and TM6 was to:

- characterize subsurface sediment type (lithology),
- interpolate subsurface conditions between control boreholes,
- locate the possible occurrence of saturated soils,
- assist in selecting locations for groundwater samples,
- assist in selecting locations for monitoring wells, and
- evaluate soil parameters (i.e., shear strength, etc...), to a lesser degree for this investigation.

The scope, as specified in the OU5 Work Plan, was to perform CPT in two lines with a maximum of 100 ft between locations. One line was to be between the Original Landfill and the SID; the second line was to be placed between the SID and Woman Creek. As specified in TM6, these were replaced by a single line located near the "toe" of the Original Landfill and south of the SID with a maximum of 100 ft between locations. This was planned such that there was the same number of CPT locations as indicated in the OU5 Work Plan. Figure 2.4.4.1-1 presents the locations of the 23 CPT sites (CPT05193 through CPT07393)..

2.4.4.1.2 Field Procedures

Field work related to the CPT was conducted in accordance to SOP GT.21. To the extent possible, as dictated by topography and surface, as well as subsurface conditions, CPT locations were installed at 100 foot centers. Some locations changed from the proposed locations presented in TM6 due to site specific conditions encountered in the field (such as buried obstructions). Where CPT refusal was encountered, the equipment was removed and an offset penetration attempted. Offsets were within a radius of 3.3 to 10 ft from the original location when topography allowed. The deepest CPT location at each site was surveyed and is shown on Figure 2.4.4.1-1.

Penetration depth of each CPT was to bedrock, refusal after a minimum of 2 ft below the groundwater (saturated) table, or refusal after three attempts at one site. If the presence of water could not be substantiated during advancement of the CPT, the rods were inspected for the presence of water after pulling them. If water was still not detected, a water level indicator was lowered into the CPT hole to check for water. Typically, this was done at least 30 minutes after completion of the CPT hole. Subsequent to measuring the water level, the CPT location was grouted. Water level information was used in the analysis of soil types.

2.4.4.1.3 Results

Of the 23 CPT sites, three locations (CPT06193, CPT07193, and CPT07293) were abandoned after three failed attempts to reach bedrock. Drive depth from the surface for the remaining CPTs ranged from 2.8 (CPT06993) to 31.2 ft (CPT07393), averaging about 16 ft. Appendix F contains:

- discussion of field and interpretative procedures,
- CPT sounding logs (strip recorder printouts), and
- CPT interpretative profiles.

Table 2.4.4.1-1 is a summary of total depth, depth to bedrock, depth to groundwater during testing, and survey coordinates. Data from Table 2.4.4.1-1 and the map of the surface with 2-foot contours were plotted on Figure 2.4.4.1-2 as a cross-section.

Depth to bedrock was estimated to range from 2 to 29.7 ft. Figure 2.4.4.1-2 clearly shows five significant bedrock lows (locations CPT05593, CPT05793, CPT05893, CPT06193, and CPT06893). Water was found to be present in three of the bedrock lows (locations CPT05993, CPT06193, and CPT06893). The bedrock lows identified at locations CPT05593 and CPT05793 were dry. Even though there is a bedrock high, water was identified at locations CPT07193 and CPT0739. As discussed in subsequent sections, well points installed at these locations confirmed the presence or absence of water as indicated by CPT. Locations for monitoring wells were in part selected based on the CPT information.

As discussed above, the overall purpose of CPT program was achieved because:

- subsurface sediments were characterized,
- subsurface conditions between control boreholes could be interpolated,
- saturated soils were identified,
- information collected was used to select locations for groundwater samples (well points),

- information collected was used to select locations for monitoring wells, and
- soil parameters of undrained shear strength, N, and phi angle were calculated.

2.4.4.2 Well Points

Performance of one-time groundwater sampling associated with the CPT program was proposed in the OU5 Work Plan as part of Stage 4 of the Phase I RFI/RI of IHSS 115. TM6 specified locations for groundwater samples and analyte lists. The Work Plan stated that groundwater be sampled with a BAT® (or equivalent) sampling device. TM6 specified that the groundwater samples be obtained using well points rather than the BAT® because of advantages related to sampling intervals (i.e., screened length) and sample volumes (EG&G, 1993e).

2.4.4.2.1 Introduction

The overall purpose of the well point sampling program as stated in both the OU5 Work Plan and TM6 was to establish the presence and extent of groundwater contamination, potential migration pathways from the Original Landfill, and future monitoring well locations. The overall scope of well point sampling was to:

- obtain groundwater samples at 50-foot intervals through any anomalies identified in the southern (downgradient) three lines of the soil gas survey, and
- obtain one or two groundwater samples in significant bedrock lows as identified with the CPT.

Selection of the well point locations was dependant on results of the soil gas surveys, CPTs, and information from other investigations performed during Stages 1, 2, and 3 of the Phase I

RFI/RI. Since there were no soil gas anomalies in the lower three lines (as presented in Section 2.4.2.2), well points were not installed at soil-gas-located anomalies. Locations of ten well points installed in bedrock lows are shown on Figure 2.4.4.1-1.

A single well point (59893) was installed in the "dry" bedrock low identified by CPT05593. Four well points (59993, 60093, 60193, and 60293) were installed in the significant bedrock low identified by CPT05993, CPT06093, CPT06193, and CPT06293. Well point 60393 was installed in drainage below the location of IHSS 196, well point 60493 was installed in the bedrock low identified by CPT06793. Well points 60593, 60693, and 60793 were installed near the west side of the landfill, where groundwater was identified in CPT07193 and CPT07393.

2.4.4.2.2 <u>Installation and Sampling Procedures</u>

Well points were installed in accordance with DCN 93.02 to SOP GT.06. Well points with more than a few inches of water in them were developed by surging and pumping with a peristaltic pump. Development typically progressed until the well points were dry, rather than based on turbidity.

In addition to attempting to sample the ten well points installed as part of the CPT program, six other well points or mini-wells were sampled as follows:

- 60893, 60993, and 61093 were installed at soil gas anomalies as discussed in Section 2.4.3.3;
- 62793 and 62893 were installed as part of a seeps and springs study being conducted by EG&G; and
- 63193 was installed as replacement for monitoring well due to overhead powerlines (Section 2.4.4.3).

A duplicate sample was obtained at 61093. A downhole inertia pump, small diameter tubing, or a peristaltic pump were used to obtain groundwater samples. Analysis parameters and sequence of collection, in order of priority, for all groundwater samples are shown on Table 2.4.4.2-1, as well as which analytes were filtered. Table 2.4.4.2-2 is a summary of which well points were sampled and for what analyses.

2.4.4.2.3 Results

Table 2.4.4.2-3a-c is a summary of constituents detected at concentrations greater than BUTLs for each set of sampling points (i.e., well points, soil gas wells, and seep/spring well points). The following paragraphs are discussions of specific results that exceeded background.

Metals. The sample from 61093 contained 275 μg/L of lithium, 101 μg/L of nickel, and 2,575 μg/L of strontium (Table 2.4.4.2-3b). These concentrations are approximately two to three times greater than their respective BUTLs. In the sample from 61093, calcium and magnesium are approximately four times the BUTLs. Manganese was detected in the sample from 60293 at a concentration of 346 μg/L versus the BUTL of 331.64 μg/L (Table 2.4.4.2-3a).

Radionuclides. Total activities of radium-226 are approximately three times higher then the BUTL in samples from 59993 and 60293. Strontium-89/90 was marginally greater than the BUTL in the sample from 60293 (1.5 pCi/L for the sample versus a BUTL of 1.15 pCi/L). These were the only radionuclides detected exceeding the respective BUTLs.

Water Quality Parameters. Orthophosphate was detected exceeding the BUTL for filtered samples in samples from both 60293 and 61093 but were below the maximum background concentration of 0.2 mg/L. These samples were not filtered and therefore may be within the background population. Total dissolved solids exceeded the BUTL in the sample from 61093.

Pesticides, Polychlorinated Biphenyls (PCBs), and Semi-Volatile Organic Compounds. Pesticides, PCBs, and SVOCs were not detected in groundwater samples from the well points, except two unknown TICs were found in the sample from the sample from 60293. Unknown-1 was detected at an estimated concentration of 5 μg/L, and unknown-2 was detected at an estimated concentration of 68 μg/L.

Volatile Organic Compounds. Samples from 60493, 62893, and 61093 were the only samples to contain detected levels of VOCs. All of the organic chemicals (except TCE) listed in Table 2.4.4.2-3a-c were detected at concentrations within an order of magnitude of the detection limit. TCE was the only constituent detected more than an order of magnitude greater than the detection limit and it was detected in the sample from 61093 at a concentration of 150 μg/L. TCE was one of the constituents found in the soil gas anomaly. 1,1,1-TCA was also detected in both the groundwater and soil gas.

In summary, the following is a list of constituents detected in samples of groundwater from within the footprint of the Original Landfill at concentrations exceeding the BUTLs:

- lithium, nickel, and strontium;
- common anions of calcium, magnesium, and manganese;
- radium-226 and strontium-89/90;
- general water quality parameters of orthophosphate and TDS; and
- VOCs of acetone, 1,1-DCE, 1,2-DCE, 1,1,1-TCA, TCE, and PCE.

2.4.4.3 Groundwater Investigation

The OU5 Work Plan also specified that groundwater monitoring wells be installed and sampled as part of the Stage 4 investigation of IHSS 115. The following subsections discuss the installation, sampling, and results obtained from wells installed in the area of IHSSs 115 and 196.

2.4.4.3.1 Introduction

According to the OU5 Work Plan (DOE, 1992a), seven monitoring wells were to be installed at IHSS 115 as part of the OU5 Phase I RFI/RI. The Work Plan also stipulated that exact location, type, and number of monitoring wells would depend on the results of Stages 1 through 3 of the Phase I investigation, and that this information would be presented in a TM. A letter dated June 18, 1993 replaced this proposed TM (Appendix A). This letter proposed that five wells be installed downgradient of the landfill and one installed within IHSS 196 (Figure 2.4.4.3-1). The purpose of these wells was to monitor present and future contaminant levels downgradient of the landfill and to help establish future or present contaminant migration problems.

The final proposed locations of these wells were selected based on information provided by the CPT survey and the soil borings. The results of the CPT survey and borehole logging provided depth-to-bedrock and groundwater information. From this information, a bedrock/alluvium-contact contour map was developed, and wells were proposed to be placed in locations where bedrock lows and/or groundwater were suspected to be present.

Upon completion of well installation activities, two areas within IHSS 115 were selected for field characterization of aquifer parameters. These locations were selected based on the lithologic and hydrologic characteristics identified during drilling, core logging, and well development activities. Characterization of aquifer parameters was necessary to provide information for the hydrogeologic groundwater flow model to be developed as directed in the OU5 Work Plan.

2.4.4.3.2 Field Procedures

Seven groundwater monitoring wells were installed in the IHSS 115/IHSS 196 area and one was installed in the surface disturbance east of IHSS 115 (Figure 2.4.4.3-2). Two of the wells (60993 and 61093) were installed as a part of the soil gas anomaly investigation discussed in Section 2.4.3.3. In addition to the boreholes completed as groundwater monitoring wells, two boreholes (59193 and 59293, originally intended to be monitoring wells) were also drilled. These boreholes were not completed as wells because they did not produce water during drilling.

Hollow-stem augers were used for advancing five of the eight boreholes (59393, 59493, 59593, 59793, and 61293) in which wells were installed. These wells were installed in accordance with SOP GT.06. Boreholes 60993, 61093, and 63193 were advanced using a hydraulically-driven Kansas Sampler (a solid core barrel) in accordance with SOP GT.02. These boreholes were installed using this alternative procedure due to difficulty accessing their locations with a standard drilling rig. The borings were drilled 5 ft into weathered bedrock in accordance with the OU5 Work Plan (DOE, 1992a). During the drilling of the boreholes, soil samples were collected for chemical and geologic analyses.

The sampling techniques employed consisted either of driving a split-spoon sampler using a 140-pound slide hammer (using hollow-stem augers), or hydraulically driving a core barrel (using the Kansas Sampler) to collect the soil samples. Once the sampler was removed from the borehole and opened (or as in boreholes 60993, 61093, and 63193, the soil was removed), its contents were scanned with an alpha and a beta/gamma probe to detect radioactivity, and an OVM to detect VOCs. The amount of recovered core was then measured, examined visually for the presence of waste material, and the lithology classified and logged.

Soil samples were collected continuously from ground surface to the first bedrock interval. Discrete samples were collected in 3-inch or 6-inch stainless steel liners, depending on the sampling method, from every 2-foot interval and analyzed for TCL VOCs. Six-foot composite samples were also collected and analyzed for TAL metals, TCL SVOCs, total uranium, plutonium, americium, gross alpha, and gross beta as specified in the OU5 Work Plan (DOE, 1992a). In order to obtain these 6-foot composite core samples, the recovered core was placed in a safe location, out of direct sunlight, until three consecutive 24-inch, or four consecutive 18-inch samples, totaling the required 6 ft, were collected. Soil was then collected from the 6-foot interval of recovered core, mixed into a composite sample, and placed in appropriate containers for laboratory analysis according to SOP FO.13.

In addition to the 6-foot composite samples and the discrete samples, 2-foot composite samples were collected from the top 2 ft of the boreholes to assist in the ecological assessment study. These samples were analyzed for the same constituents as listed above, with the exception VOCs.

Following the completion of a boring, 2-inch inside-diameter PVC wells were installed in accordance with SOP GT.06 in borings 59393, 59493, 59593, 59793, and 61293. A 0.5-inch PVC well was installed in borings 60993, 61093, and 63193 in accordance with SOP GT.06. The 2-inch wells were constructed inside 6-1/4-inch ID hollow-stem augers. The bottom of the screened interval was located at or near the bedrock/alluvium contact. Wells 59393, 59493, 59793, and 61293 were installed with 5-foot well screens, and well 59593 was installed with a 10-foot well screen (Figure 2.4.4.3-3). Silica sand was installed within the annulus between the borehole and the well casing from just below the bottom of the screened interval to from 0.5 to 5 ft above the top of the screened interval, depending on the thickness of the alluvium above the screened interval. Bentonite seals were installed above the filter packs at thicknesses ranging from 1.5 to 2.3 ft. The wells were then completed by filling the remaining annulus with concrete; installing a steel, locking, protective casing; and constructing a 3- by 3-foot concrete pad around the protective casing.

Wells 60993, 61093, and 63193, containing the 0.5-inch casing, were constructed inside 1-3/8-inch open holes. In well 60993, the bottom of the 5-foot screen was placed 4.1 ft below the bedrock/alluvium contact. In wells 61093 and 63193, the bottoms of the 10-foot screens were placed 4 and 5.6 ft below the bedrock/alluvium contacts, respectively (Figure 2.4.4.3-4). In each borehole, silica sand was installed within the annulus between the borehole wall and the well casing from the bottom of the screened interval to 2 to 9.9 ft above the top of the screened interval. Bentonite seals were installed above the filter packs at thicknesses ranging from 0.1 to 0.9 ft. The wells were then completed by filling the remaining annulus with concrete; installing a steel, locking, protective casing; and constructing a 3- by 3-foot concrete pad around the protective casing.

All of the wells installed in IHSS 115 are being sampled on a quarterly basis. The first round of quarterly sampling was conducted during June 1993. These groundwater samples are analyzed for the following if enough groundwater is present at the time of sampling: unfiltered total chromium, beryllium, nitrate, gross alpha, gross beta, uranium-233/234, uranium-235, uranium-238, plutonium-239/240, americium-241, TAL metals, TCL VOCs, TCL SVOCs; and filtered total uranium, plutonium-239/240, cesium-137, strontium-89/90, americium-241, lead, total chromium, anions, and TDS.

Based on development and sampling histories, only two wells in IHSS 115 (59493 and 59593) were judged to be productive enough to warrant aquifer testing. An aquifer pumping test was performed on well 59493, and a slug test was performed on well 59593 (Figure 2.4.4.3-5).

Well 59493 is located within IHSS 196. The geologic logs of well 59493 indicated the presence of permeable and porous material, predominantly sand and gravel with some clay, along with landfill material, including glass, some wood chips, and metal pieces. Three 0.5-inch diameter well points were installed as observation wells (well points 63893, 63993, and 64093) at approximately 3, 6, and 9 ft from the pumping well (Figures 2.4.4.3-5 and 2.4.4.3-6). The installation of these well points is discussed in Section 2.4.4.2.3 above. The pumping well (59493) was developed in accordance with SOP GW.02. The observation wells were developed using a "rawhiding" method, wherein the water is pumped and allowed to fall back into the wellbore repeatedly. This procedure was repeated until the well produced clean water.

Prior to the aquifer pumping test, a step test was performed with a peristaltic pump at well 59493 to gather preliminary aquifer data. The data were used to determine optimum pumping rates for the aquifer pumping test. The results of this step-test indicated that a single pump with a pumping rate of 0.18 gallons per minute (gpm) was not sufficient to achieve analyzable results in the most distant observation well. Therefore, when the aquifer pumping test was performed, two peristaltic pumps with a combined pumping rate of 0.51 gpm were used. A transducer was installed in pumping well 59493 to electronically record water levels. In addition, water-level readings were taken by hand in the pumping well with a standard water-level indicator to compare to the electronically recorded water levels. Water levels were taken by hand in the three observation wells with two 3/8-inch diameter Slope Indicator meters and one manometer. The drawdown was monitored for 101 minutes. The pump was then shut down and recovering water level measurements were recorded.

Well 59593 is located downgradient of the Original Landfill near Woman Creek. The lithologic logs of this well indicated a permeable porous medium of unconsolidated clayey sand, and sand and gravel with abundant cobbles (Figure 2.4.4.3-7). A slug test was conducted using a bailer. Water levels were collected both electronically and by hand.

2.4.4.3.3 Results

The completed groundwater well program for the investigation of the groundwater flowing from the Original Landfill included the installation of a total of eight wells, three of which were mini-wells (Figure 2.4.4.3-2). The boreholes for these wells were drilled approximately 5 ft into weathered bedrock as proposed in the OU5 Work Plan (DOE, 1992a).

During the installation of the five downgradient wells (59393, 59593, 59793, 61293, and 63193), two of the locations did not produce groundwater. These well locations were plugged, abandoned, and reclassified as boreholes 59193 and 59293. New well locations were selected southwest of the original proposed location (Figure 2.4.4.3-2). The recovered core was visually logged as the boreholes were advanced, according to SOP GT.01. It was later more closely examined and classified utilizing sieves and other equipment at a designated logging facility, as required in SOP GT.01. The results of this effort indicated that bedrock was encountered in the boreholes at depths ranging from 7 to 15.4 ft. The bedrock material consisted of claystone and sandy claystone (Figure 2.4.4.3-3).

Groundwater was encountered within the alluvium at depths ranging from 6.1 to 10.5 ft at the time of drilling. Of the five downgradient wells, only wells 59593 and 63193 had discernable saturated intervals at that time. The remaining three wells had little to no water. Cross-sections in Figures 2.4.4.3-3 and 2.4.4.3-4 show the screened intervals of these wells and the water levels measured during the most recent sampling event.

During the drilling of these boreholes, field monitoring was conducted on the core. The monitoring results from the OVM, the alpha and beta/gamma probes, and radiation smears were all below background levels.

Monitoring Well Borehole Soil Samples. The analytical results from the soil samples collected from the IHSS 115 monitoring well boreholes available as of January 28, 1994 included TAL metals, radionuclides, pesticides, PCBs, SVOCs, and VOCs. Table 2.4.4.3-1 presents a summary of results for metals and radionuclide constituents detected at concentrations exceeding BUTLs in the IHSS 115 groundwater monitoring well borehole soil samples. In addition, Table 2.4.4.3-1 presents a summary of results for organic constituents (pesticides, PCBs, semi-volatiles, and volatiles) detected in the soil samples. Figure 2.4.4.3-8 shows those constituents that were detected in concentrations exceeding background in soil samples from monitoring well boreholes.

Metals. The TAL metals analyses resulted in six constituents (copper, chromium, nickel, silver, zinc, and manganese) exceeding BUTLs. Two composite samples from well 59493 at depths of 0 to 6.3 and 6.9 to 12.9 ft had copper concentrations (6,920 and 117 mg/kg, respectively) exceeding the BUTL. In addition to copper, the sample from well 59493 at a depth of 0 to 6.3 ft had concentrations of chromium, nickel, silver, and zinc exceeding BUTLs (77, 92, 36, and 673 mg/kg, respectively). One composite sample from well 63193 at a depth of 12 to 20 ft had a nickel concentration (85 mg/kg) exceeding the BUTL, and one sample from well 59593 at a depth of 0.75 to 1 foot had a manganese concentration exceeding the BUTL (1280 mg/kg).

Radionuclides. Radionuclide constituents were detected at concentrations exceeding BUTLs in two soil samples collected from IHSS 115 monitoring well boreholes. Plutonium-239/240 was detected in a soil sample collected from monitoring well borehole 59193 at a depth of 2 to 8 ft at a concentration of 0.065 pCi/g. It was also detected in a sample collected from monitoring well borehole 59793 at a depth of 6.5 to 10.8 ft at a concentration of 0.074 pCi/g.

One rinsate sample taken during the installation of well 59593 had a uranium-233/234 concentration of 0.73 pCi/L. If uranium-233/234 was detected in the soil samples collected using this equipment, a detection of this constituent in the rinsate could be important. It may have indicated that inadequate decontamination of field-sampling equipment may have affected the soil sample results. However, because all of the soil samples had concentrations of uranium-233/234 well below the BUTL, this detection was judged to be insignificant.

Pesticides and Polychlorinated Biphenyls (PCBs). One pesticide constituent was detected in a soil sample taken from monitoring well borehole 59493 at a depth of 0 to 6.3 ft. Aroclor-1254 was detected at a concentration of 630 μg/kg.

Semi-Volatile Organic Compounds. SVOCs were detected in eight samples from four monitoring well boreholes (59493, 59593, 61293, and 63193) in IHSSs 115 and 196. Table 2.4.4.3-2 details the locations, sample numbers, depths, number of constituents detected in each sample, and the range of concentrations detected in each sample.

In addition to the SVOCs discussed above, 26 TICs were detected in soil samples collected from the IHSS 115/196 monitoring well boreholes. The estimated concentrations of these compounds ranged from 77 to 2,700 μg/kg.

Volatile Organic Compounds. Soil samples from six of the eight monitoring well boreholes in IHSS 115 had detectible VOCs as did soil samples from both of the locations that were converted to boreholes. Table 2.4.4.3-3 details the locations, sample numbers, depths, number of constituents detected in each sample, and the range of concentrations detected in each sample. Two constituents, methylene chloride and acetone, were also found in a rinsate sample collected during drilling and sampling activities at monitoring well borehole location 59593 on June 15, 1993. These constituents were detected in the rinsate sample at concentrations of 1 and 13 μg/L, respectively.

Monitoring Well Groundwater Samples. The analytical results of the groundwater samples collected from the monitoring wells at IHSS 115 during the quarterly sampling events available as of January 28, 1994 include TAL metals, radionuclides, pesticides, PCBs, SVOCs, and VOCs. Table 2.4.4.3-4 summarizes the results for TAL metals and radionuclide constituents detected at concentrations exceeding BUTLs in the groundwater samples. Table 2.4.4.3-4 also summarizes the results for organic constituents detected in the groundwater samples.

Metals. The TAL metals analyses identified three unfiltered samples containing 21 constituents (aluminum, barium, beryllium, calcium, chromium, cobalt, copper, iron, lithium, lead, manganese, magnesium, mercury, nickel, potassium, silicon, silver, vanadium, strontium, tin, and zinc) that exceeded BUTLs (Table 2.4.4.3-5). One sample collected from well 59493 on June 24, 1993 had 15 constituent concentrations exceeding BUTLs. A sample taken from this same well on August 11, 1993 had six constituent concentrations exceeding BUTLs. A sample taken from well 59593 on June 24, 1993 resulted in 20 constituent concentrations exceeding BUTLs.

Radionuclides. Radionuclide constituents were detected at concentrations exceeding BUTLs in four of the groundwater samples collected to date from the IHSS 115 groundwater monitoring wells. These four samples came from wells 59493 and 59593. Two samples from well 59493 collected on June 24, 1993 and August 11, 1993 contained plutonium-239/240 at concentrations of 0.13 and 0.17 pCi/L, respectively. The sample collected on August 11 also contained americium-241 and radium-226 at concentrations of 0.046 and 4.4 pCi/L, respectively. A groundwater sample collected from well 59593 on June 24, 1993 contained americium-241 at 0.039 pCi/L and one collected on August 13, 1993 contained radium-226 at 3.5 pCi/L.

Pesticides and Polychlorinated Biphenyls (PCBs). No pesticides or PCB constituents were detected in the groundwater samples collected to date in the IHSS 115 monitoring wells.

Semi-Volatile Organic Compounds. Three groundwater samples collected to date from the IHSS 115 monitoring wells contained detectible SVOCs (Table 2.4.4.3-6). A sample collected from well 59493 on June 24, 1993 contained seven SVOCs at concentrations ranging from 3 to 13 μg/L. A second sample from this well, collected on August 11, 1993 contained seven SVOCs at concentrations ranging from 2 to 9 μg/L. A sample collected from well 59593 on August 13, 1993 contained one SVOC at a concentration of 6 μg/L.

In addition to the SVOCs discussed above, one TIC was detected in a groundwater sample collected from well 59493 on June 24, 1993. This compound was detected at a concentration of 9.6 μg/L (Table 2.4.4.3-6).

Volatile Organic Compounds. One groundwater sample collected to date from the IHSS 115 monitoring wells contained a detectible VOC. This sample was collected from well 59493 on August 11, 1993. The sample contained methylene chloride at a concentration of 6 μg/L.

Aquifer Test Results. Table 2.4.4.3-7 provides a summary of the IHSS 115 aquifer tests analyses. The aquifer test analysis computer software AQTESOLV (Geraghty & Miller, 1989) was used to perform these analyses. The aquifer test data from pumping well 59493 and observation well 63893 were analyzed using the Neuman (1975) method for unsteady flow to a well in an unconfined aquifer with delayed gravity response (Figures 2.4.4.3-9 and 2.4.4.3-10). The Theis (1935) method for unsteady flow was used to analyze data from observation wells 63993 and 64093 (Figures 2.4.4.3-9 and 2.4.4.3-10). The results of the analyses for wells 59493 and 63893 were similar with transmissivities in the range of 0.02 to 0.05 square ft per minute (Figures 2.4.4.3-9 and 2.4.4.3-10). Analyses of the data from wells 63993 and 64093 resulted in transmissivities of 0.20 to 0.23 square ft (Figures 2.4.4.3-9 and 2.4.4.3-10). The range in hydraulic conductivities is consistent with expected heterogeneities.

The slug test data from pumping well 59593 were analyzed using Bouwer and Rice's (1976) method for slug tests in unconfined aquifers. This analysis resulted in a hydraulic conductivity of 4.3 x 10^{-4} ft per minute. However, analysis of the data indicated that it may not be representative of the formations characteristics (the data may represent the hydraulic conductivity of the filter pack).

2.4.5 Stage 5

Stage 5 activities at IHSS 115 involved investigation of the storm sewer pipelines that protrude from the IHSS 115 area. The following subsections discuss the implementation and results of this investigation.

2.4.5.1 Investigation of Storm Sewer

This section describes the activities performed to investigate the storm sewer pipelines. These activities included collecting a one-time sample of the water discharging from the active pipeline and performing a video-camera survey of the storm sewer system to determine/verify connections and the source of the constant discharge from the system.

2.4.5.1.1 Introduction

Monitoring site SW500 (see Figure 2.4.3.4-1) is located at the outfall of the storm sewer system which discharges from the 400 Area of the RFP industrialized area into the SID (Figure 2.4.5.1-1). The storm sewer system is constructed of reinforced concrete pipe (RCP) ranging in diameter from 15 to 30 inches within the industrialized area and corrugated metal pipe (CMP) ranging in diameter from 36 to 54 inches within the south buffer zone. The entire system consists of 4,014 linear ft (lf) of underground storm sewer pipe, which is divided into 26 segments, each separated by a manhole or inlet (Table 2.4.5.1-1). This storm sewer system collects surface water runoff, primarily from parking lots and rooftops. The interior of the entire system was visually inspected using a closed-circuit television (CCTV) camera and monitor. This CCTV inspection used the procedures outlined in the Environmental Restoration Management Instruction Manual for Video Inspection of Pipelines, 21000-SUI-SW.01.

2.4.5.1.2 Sampling Procedures

A one-time stream/ditch sample was collected at monitoring site SW500 on October 5, 1992 (Table 2.4.3.4-4). This sample was processed for laboratory analyses for the four general categories of chemical constituents as indicated in Table 2.4.3.4-3.

The CCTV inspection of the interior of the entire storm sewer system was conducted by subcontractor personnel in an effort to determine the source of the continuous flow of water from the downstream end of the system. The inspection was begun on April 13, 1993 and finished on April 23, 1993. The work was done segment-by-segment by manually pulling a 4-inch CCTV mounted on a skid in a downgradient direction, while viewing the pipe conditions on a television monitor and recording the results on tape using a video cassette recorder (VCR). A hand-written log was prepared during the video taping which documented the pipe length, size and type, and the conditions viewed on the monitor.

2.4.5.1.3 Results

Analytical results of the single 400-Area storm-sewer sample are included in EG&G (1993j, Appendix Tables J-1 through J-4). The source of water was attributed to groundwater collected by the Building 447 foundation underdrain system, and therefore, the analytical results have been compared to BUTLs for groundwater. No particularly elevated concentrations were noted for radionuclides, trace metals, or priority pollutants (organic constituents) associated with these resultant analyses.

For the most part the storm-sewer system had only small rocks and sediment along its invert, some slight groundwater inflows at joints and manholes, and an occasional 6-inch PVC roof drain connection entering through the top part of the pipe. However, a continuous dry-weather discharge was seen entering the system through a 12-inch CMP at Manhole 2 from the Building 447 foundation underdrain system (Jacobs, 1994). Manhole 5 had an intermittent high-velocity inflow which entered the manhole through a 6-inch PVC located at the southeast corner of the manhole. This inflow appeared to be pumped into the manhole from a sump pump. Based on the location of the pipe, the flow is assumed to be coming from Building 440 or the evaporative cooling tower located along the west side of Building 440.

2.4.6 Ambient Air Monitoring

Ambient air monitoring was conducted to assess airborne dispersion of radioactive materials from RFP into the surrounding area and also to investigate the primary release mechanism of fugitive dust wind erosion of radiologically contaminated surface soils from IHSS 115 and IHSS 133 in OU5. Health and safety (H&S) monitoring for personnel protection provided some additional information about the potential release mechanisms of volatilization of organic gases and of airborne transport of radiological contaminants and hazardous materials from surficial and subsurface soils.

2.4.6.1 Introduction

An extensive air monitoring network known as the Radioactive Ambient Air Monitoring Program (RAAMP) is maintained at RFP in order to monitor airborne dispersion of radioactive materials from RFP facilities. The focus of RAAMP is directed towards collection and documentation of air data and production of environmental reports (EG&G, 1991a). Twenty-three onsite samplers are located within RFP, concentrated near the main facilities area (Figure 2.4.6.1-1). Fourteen perimeter samples border RFP along the major highways to the east, south, north, and west

(Figure 2.4.6.1-1). There are currently seven air monitoring stations (S-10, S-11, S-13, S-14, S-23, S-37, and S-38) near the Woman Creek drainage. Fourteen community samplers are located in metropolitan areas adjacent to RFP (EG&G, 1993k).

Three samplers were installed in November 1992 specifically to monitor ambient radionuclide levels around OU5 (Figure 2.4.6.1-2). Sampler S102 is located north and west of OU5 as an upwind monitor. Sampler S100 is situated downwind of IHSS 115. Sampler S101 is placed downwind of IHSS 133.

Ambient air quality in the immediate vicinity of an IHSS during field activities can be inferred from the results of H&S monitoring that was conducted during the Phase I RFI/RI investigations. During all ground-disturbance activities at OU5, such as drilling bore holes and installing soil gas probes, an assigned H&S person routinely and frequently monitored the immediate location of the ground intrusion and any extracted soil samples for volatile organic gases and radiation. The H&S person also periodically monitored the breathing zones of workers.

2.4.6.2 Sampling Procedures

EG&G Rocky Flats, Inc., Environmental Monitoring and Assessment Technologists (EMAT) operate and maintain the RAAMP samplers. Samplers operate continuously at a volummetric flow rate of approximately 12 liters per second (L/s) (25 cubic ft per minute (ft^3/min)), collecting air particles on 8- by 10-inch fiberglass filters. Manufacturer's test specifications rate this filter media to be 99.97 percent efficient for relevant particle sizes under conditions typically encountered in routine ambient air sampling.

Performance data on the samplers are collected by EMAT on a weekly basis. RAAMP filters are collected biweekly. Once a month, the two filters collected from each air monitoring station are composited prior to isotopic analysis. Detailed procedures describing the air sampler operations, filter exchange, filter preparation for analysis, RAAMP documentation, and reporting requirements are contained in EG&G SOPs. These air samples are analyzed according to the procedures outlined in the General Radiochemistry and Routine Analytical Services Protocol (GRRASP) (DOE, 1992a). All routine ambient air filters are analyzed for plutonium-239/240 (EG&G, 1993k). Eight selected onsite ambient air filters are also analyzed for americium-241 (EG&G, 1991a).

The EMATT staff operated and maintained the three OU5 air samplers according to the same procedures as the RAAMP samplers. Filters from these three special samplers were analyzed as are those from the regular RAAMP samplers in accordance with procedures specified in SOP AP.13. All special samplers will become permanent sites in the RAAMP network.

H&S monitoring of organic gases was performed with a Thermo Environmental 580B OVM. At the beginning of each work day, prior to any field activities, an assigned H&S person calibrated the OVM to a reference gas of 100 ppm isobutylene according to manufacturer's instructions. During drilling and boring for soil samples, the H&S person passed the OVM over the extracted sample before the sample was collected. When close monitoring of a soil sample or the location of ground intrusion indicated elevated levels of organic gases, the H&S person would periodically monitor the breathing zones of the field workers with the OVM.

The H&S person followed similar procedures for radiological monitoring during field activities. A Ludlum 12-1A meter was used for monitoring alpha radiation, and a Ludlum 31 instrument was used for monitoring beta and gamma radiation. An assigned H&S person conducted visual and performance tests and a source check on each instrument daily before any field activities. Procedures for calibrating radiological instruments are outlined in the Environmental Management Radiological Guidelines (EG&G, 1994b). Monitoring during drilling followed a procedure identical with that for organic gases; that is, every extracted interval of soil during the drilling of a borehole was screened with both the alpha and the beta-gamma meters before the sample was handled for sample collection. Personnel monitoring was performed when indicated by elevated field readings.

2.4.6.3 Results

Ambient air monitoring data collected by the RAAMP for selected locations associated with OU5 were examined (Table 2.4.6.3-1 and Appendix B.7-1). These RAAMP sampler locations are shown in Figure 2.4.6.1-1. Because prevailing winds are from the west and northwest, S-32 can be considered the most isolated background (upwind) sampler of the RAAMP network. S-13 and S-14 can also be considered upwind of OU5. S-13 is north of IHSS 115, and S-14 is north of IHSS 133. S-23 is situated directly below IHSS 133 in the Woman Creek drainage and, hence, is a candidate sampler for assessing OU5 emissions. S-38 is also in the Woman Creek drainage at the east facility property line on Indiana Street.

That RAAMP data surveyed were for the time period during which the special OU5 samplers have operated and have had results reported, that is, from October 1992 through August 1993. The RAAMP filters are analyzed only for plutonium-238 and plutonium-239. Caution is required in interpreting the representativeness and accuracy of individual values, as occurs when sampling periods are short. The measured concentrations of radionuclides are at or very near background, and often there is little or no amount of these materials on the filter media. when this is the case, data must be reviewed carefully for anomalies, laboratory analytical blank values, and propagated statistical counting uncertainty.

With S-32 considered as the background upwind sampler, the average plutonium-238 results of the other four samplers examined are within the same order of magnitude as background. (An explanation of the S-23 plutonium-238 results has not yet been made.) Plutonium-239 results for S-13, S-14, and S-23 samplers average one order of magnitude greater than the background sampler, while the S-38 plutonium-239 results average two orders of magnitude greater than background.

Analysis and validation of the ambient air data from the three special samplers for OU5 have been slow. As of March 1, 1994, results of 12 samples from each monitor representing the period from October 9, 1992 to August 4, 1993 have been entered into the RFEDS. Each samples has been analyzed for americium-241, plutonium-239/240, uranium-233/234, uranium-235, and uranium-238. Of the 12 samples, only the first two samples (October 9, 1992 and November 10, 1992) have been validated. The remaining ten samples remain in the validation process. All data for radionuclides should be used as detects, except for data rejected in the validation reviews (Appendix B). Analytical results for the OU5 air samples are presented in Table 2.4.6.3-2 (also see Appendix B.7-2). Descriptive statistics are based on accepted data plus invalidated data still in the validation process.

Examination of the special OU5 sampler data indicates that the uranium-233/234 and uranium-235 results are within the same order of magnitude for both the S-100 sampler downwind of IHSS 115 and the S-102 sampler upwind of OU5. These preliminary data appear to indicate no discernible contributions to ambient concentrations of either uranium-233/234 or uranium-235 from IHSS 115. The americium-241, plutonium-239/240, and uranium-238 average concentrations for the downwind S-100 sampler are one order of magnitude greater than the average concentrations of the upwind S-102 sampler. Contributions to ambient concentrations of americium-241, plutonium-239/240, or uranium-238 by IHSS 115 appear possible. In all cases, for all data, conclusions about possible radionuclide emissions from IHSS 115 can be made only after complete statistical analysis of validated data.

Results of the H&S monitoring that was done during the field investigations of IHSS 115 provide a qualitative indication of potential air pathway risks attributable to this source. Elevated organic vapor readings of 22.3 ppm were observed during investigations at location 57893 and 7 ppm at location 58393, both in IHSS 115. During field investigation of HPGe anomalies B-7 and B-8, beta-gamma monitoring registered 60,000 counts per minute (cpm) on one occasion and 10,000-80,000 cpm on another.

2.5 IHSS 133 (ASH PITS, INCINERATOR, AND CONCRETE WASH PAD)

The following sections discuss the Phase I RFI/RI activities conducted at the Ash Pits (IHSS 133.1 to 133.4), Incinerator (IHSS 133.5), and Concrete Wash Pad (IHSS 133.6).

2.5.1 Stage 1 - Review of Existing Data

The OU5 Work Plan specified that historical aerial photographs of the IHSS 133 area be reviewed to determine the extent of each of the disposal areas. The review of the photographic coverage of IHSSs 133.1 through 133.6 indicated that 133.1 and 133.3 are apparently mislocated on Figure 2-6 of the OU5 Work Plan (DOE, 1992a) and that other suspect features exist that required investigation in subsequent stages of the investigation.

During the course of this investigation, it was determined that the location of IHSS 133.1 as shown on Figure 2-6 in the OU5 Work Plan and in the first several TMs prepared was erroneous. As shown on Figure 2.5.1-1, IHSS 133.1 is actually the northern most trench previously identified as belonging to IHSS 133.3.

IHSS 133.3 is clearly defined on an oblique aerial photograph taken June 6, 1969 and is located approximately as shown on Figure 2.5.1-1. In addition, the pit that comprises IHSS 133.3 can be identified on a 1964 aerial photograph (EPA, 1988) and scaled to the map at a location that is in agreement with the location shown on the 1969 oblique photograph.

Other features identified on the photographs in EPA (1988) include: a trench to the south of IHSS 133.5 (identified on the 1964 photograph); an ash dump to the north of IHSS 133.5 (identified on the 1988 photograph); and an ash dump and possible pit to the north of the above site (1969 photograph). A north-south ash pile extending into the area previously identified as IHSS 133.1 was also identified on the 1964 photograph, but could not be seen on later photographs.

Two areas of disturbed ground were also located in 1955 and 1969 photographs. These are located to the west of the main access road to RFP and to the west of the IHSS 133 area. Subsequent photographs of these areas indicate no further disturbance. These areas were probably related to road construction.

Additional photographs were recently obtained from several aerial photograph companies that cover the years that were absent in the photographs previously available. As discussed in Section 2.5.2.2, these photographs confirm the presence of at least two additional pits not previously identified.

2.5.2 Stage 2

Stage 2 activities at the IHSS 133 sites included surface radiological and geophysical surveys, as were specified by the OU5 Work Plan.

2.5.2.1 HPGe and FIDLER Surveys

A radiation survey of the IHSS 133 area was initiated in the summer of 1992 using tripod-mounted, HPGe gamma-ray detector instruments. This initial survey did not cover the entire IHSS 133 area and was followed by a truck-mounted HPGe survey configured to count activity over a larger area and to provide full coverage for each of the IHSS 133 sites. In addition to the HPGe surveys, a FIDLER was used as an aid in focusing sampling investigations within anomalies identified by the HPGe surveys.

2.5.2.1.1 <u>Introduction</u>

The HPGe system is used to detect gamma radiation from radioactive elements and/or their associated daughter products. Because some of the elements are either weak or non-gamma emitting, their activities must be extrapolated from gamma emitting daughter products in the decay series.

The activities reported for the HPGe are based on the assumption that there is a homogeneous, three-dimensional distribution of the radioactive element within the soil matrix, and the HPGe data reduction algorithms average the activity over the top 3 centimeters of the soil. This assumption notwithstanding, radiation from a point source can also be detected by the HPGe; although, its specific location within the HPGe's relatively large field of view is not defined.

The HPGe's field of view is dependant upon a number of variables, among them are the height of the detector instrument above the source and the amount of gamma energy emitted by the radioactive element. These assumptions and operating conditions give the HPGe the ability to survey and speciate radioactive elements over large areas in a relatively short amount of time. Once anomalous areas are identified, FIDLER surveys were conducted on a close spaced grid can be used to define the precise location of a point source or to determine the limits of a diffuse source.

2.5.2.1.2 Survey Procedures

The 1992 tripod-mounted HPGe radiation survey of the IHSS 133 area used, single crystal, HPGe gamma-ray detector instruments operating at a height of approximately 3 ft. At this height, and assuming the source was americium-241 with a gamma radiation energy of 0.06 Mev, 90 percent of the radiation detected occurs within an approximate 40-foot diameter field of view. A 150-foot grid pattern was used for the survey. The grid spacing coupled with the 40-foot counting area gave HPGe coverage of approximately 5 percent of the total surface area of the IHSS 133 area.

To increase radiation survey coverage of IHSS 133, a second HPGe survey was conducted in the spring of 1993 using a truck-mounted system. The second survey used an array of six, 75 percent N-type HPGe detectors operating at a height of approximately 20 ft. At this height, and assuming the source is protactinium-234 (protactinium-234 is a daughter product of uranium-234 which was detected during the 1992 survey) with a gamma radiation energy of 1 Mev, 91 percent of the radiation detected occurs within an approximate 230-foot diameter field of view. The 1993 survey used a grid spacing of 150 ft, which coupled with the larger detection field, resulted in full survey coverage of the identified IHSSs.

Survey stations for both the 1992 and 1993 HPGe surveys were located by a global positioning system which provided the coordinates for each station on a real-time basis with a 3- to 15-foot accuracy. HPGe survey locations were marked in the field and were later used as reference points for the FIDLER surveys.

FIDLER surveys within each of the HPGe anomalies were conducted on a grid to ensure systematic coverage of the areas. The FIDLER surveys were conducted according to the following procedure:

- construct a square survey area measuring 300 ft on each side, which extends 150 ft north, south, east, and west of the staked location of each HPGe radiation anomaly;
- construct survey base lines oriented north to south along the eastern and western limits of the survey area and post pin flags at intervals of 4 ft along the base lines;
- record a 1-minute background count before entering the area to be surveyed;
- conduct the FIDLER survey along east to west grid lines defined by the pin flags with the instrument set on fast response and while slowly moving the instrument in a 2-foot arc from north to south on both sides of the survey line;
- stake locations that exhibit counts greater than background.

2.5.2.1.3 <u>Results</u>

The 1992 and 1993 HPGe survey, reported radioactivity in picocuries per gram for potassium-40, cesium-137, radium-226, thorium-232, uranium-235, and uranium-238. Table 2.5.2.1-1 and Figure 2.5.2.1-1 present data from the 1992 HPGe survey; Table 2.5.2.1-2 and Figure 2.5.2.1-2 present the 1993 HPGe survey data. The results of the two surveys are discussed below.

Potassium-40. Potassium-40 is a naturally-occurring radionuclide that is not known to be associated with RFP. The HPGe surveys provided no evidence to indicate anomalous activities for potassium-40 in IHSS 133.

Cesium-137. Cesium-137 activities of 0.4 pCi/g or higher are indicative of areas where the ground surface is relatively undisturbed. This determination is based upon a comparison of cesium-137 data with aerial photographs showing the original topography of the area. Areas of cesium-137 activity greater than 0.4 pCi/g represent fallout that is residual in undisturbed surface soils. Lower cesium-137 activities represent areas where the ground surface has been disturbed by mixing or covering undisturbed surface soil with subsurface soils that were not directly exposed to fallout.

Activities for cesium-137 were low along the IHSS 133 access road, at the Concrete Wash Pad (IHSS 133.6), at the Incinerator area (IHSS 133.5), along the drainage ditch, at the IHSS 133.2 and 133.4 Ash Pits, and in some locations along the bank of Woman Creek. Activities exceeding 0.4 pCi/g are dominant in the east half of IHSS 133 and in other areas where undisturbed ground is apparent in oblique aerial photographs.

Thorium-232. Thorium-232 is a naturally-occurring radioactive element. Thorium has been used in several ways at RFP since 1952 (CDH, 1992). No evidence of releases of thorium in the IHSS 133 area has been found. The results of the 1992 tripod-mounted survey indicate that thorium-232 activity ranges from 0.8 to 1.4 pCi/g and average about 1 pCi/g in the thicker alluvial sediments, which predominate at higher elevations on the northern portion of the site. Activity increases to an average of about 1.5 pCi/g on the lower elevations that are predominant on the southern portion of the site. The 1993 truck-mounted HPGe survey provided no additional information to indicate thorium-232 activity was related to anything other than natural sources.

Radium-226. Radium-226 is a daughter product derived through the decay of naturally occurring uranium-238. Inferred activities of radium-226 are calculated from the activities of lead-214 and bismuth-214, which occur after radium-226 in the uranium-238 decay series. Therefore, if a state of equilibrium exists, HPGe survey stations with the highest radium-226 activities should also exhibit the highest uranium-238 activities. This relationship is useful in evaluating uranium-238 activities as described below.

Uranium-235. In-situ activities of uranium-235 are derived from the direct measurement of gamma-ray emissions from the uranium-235 radioisotope. Elevated uranium-235 activity occurs at HPGe survey station F10 (0.375 pCi/g). The elevated activity corresponds to anomalous uranium-238 activity described below.

Uranium-238. Activities of uranium-238 are extrapolated from the gamma activity of thorium-234 and protactinium-234, which are daughter products that occur immediately after uranium-238 in the decay series. The 1992 tripod-mounted HPGe survey data indicated anomalous uranium-238 activity at survey stations F08 (7.55 pCi/g) and F10 (21.7 pCi/g). These activities are considered anomalous because radium-226 anomalies of proportional magnitude were not detected at stations F08 and F10. Survey station F08 is located immediately north of IHSS 133.4, while F10 is located between IHSS 133.4 and IHSSs 133.1 and 133.3 (Figure 2.5.2.1-1).

The 1993 truck-mounted HPGe survey corroborated the anomalous activity at HPGe station F10. Station F10 exhibited uranium-238 activity of 18.8 pCi/g, and there was not a corresponding increase in radium-226 activity at this location. The absence of elevated radium-226 activity during the 1993 survey confirms that uranium-238 activity at HPGe survey station F10 is likely due to an introduced source.

The 1993 truck-mounted HPGe survey did not corroborate the anomalous activity detected by the 1992 survey at station F08. Only 2.61 pCi/g of uranium-238 activity was detected at location F08 during the 1993 HPGe survey. The reason for the difference between the two surveys is not known; although, the activity detected during the 1992 tripod-mounted HPGe survey may be related to contaminated scrap metal in the vicinity of F08 that was identified during the FIDLER survey, the results of which are described below.

FIDLER surveys of the uranium-238 anomalies at F08 and F10 were conducted to more precisely determine the dimensions of the anomalous areas. During the FIDLER surveys, the location of the anomaly at HPGe station F10 was confirmed. The FIDLER survey indicates that the anomaly is a distributed source, approximately 35 ft wide and 76 ft long, with activity of approximately 5,000 cpm. The area is located immediately to the south and downslope of a small mound and depression in the topography. The mound and depression are adjacent to one another, and each have dimensions of about 51 ft long by 43 ft wide and exhibit activity of 2,500 cpm, which is consistent with background for the FIDLER survey. No historical information regarding the origin of the mound and depression was found during investigation of this area.

The anomaly associated with the 1992 tripod-mounted HPGe survey at station F08 was not confirmed by the FIDLER survey. This result is consistent with the findings of the 1993 truck-mounted HPGe survey for the same location. However, the FIDLER survey identified one anomalous area in the vicinity of HPGe survey station F08. The anomaly (6,637 cpm) is located between HPGe stations F07 and F08 and is associated with a pile of scrap metal (Figure 2.5.2.1-2).

Based upon the results of the two HPGe surveys and the FIDLER survey, a surface soil sample and borehole samples were collected near the northern boundary of the anomalous area. The soil sample location was coincident with the area of greatest activity as defined by the FIDLER survey. No samples were collected at HPGe survey station F08, nor were samples collected at the FIDLER survey anomaly in the vicinity of HPGe station F08, because the scrap metal source was not commingled with the soil. The results of the surface soil sample and borehole sample analyses are discussed in Sections 2.5.3.1 and 2.5.3.2, respectively.

2.5.2.2 Geophysical Surveys

Frequency-domain EM and magnetometer geophysical surveys were conducted in IHSS 133 from October through December 1992. In addition, a time-domain electromagnetic (TDEM) survey was conducted in IHSS 133 from January through February 1994. This TDEM survey was performed with a Geonics EM61 instrument, a new technology which was not available at the time the other geophysical surveys were performed or when the subsurface soil sampling plan (TM7, see Section 2.5.3.2) was generated. The performance of these surveys was specified by the OU5 Work Plan and further detailed in TM2 (EG&G, 1992a). Implementation and results of these surveys are discussed in this section.

Frequency-domain EM surveying is used to determine ground conductivity and conductivity anomalies associated with such things as buried waste pits and trenches, landfills, sludge lagoons, buried drums, or leachate plumes. A continuously transmitted primary EM field creates an eddy current flow in the subsurface. This induces a smaller secondary EM field which is measured by the geophysical instruments in the presence of the larger primary field.

The measured components of this field are the quadrature phase component (measuring ground conductivity) and the in-phase component ("metal detection" mode). Effective penetration depth is on the order of 15 ft.

Magnetometer surveying is used to delineate locations of metallic objects, such as buried drums or pits/trenches/landfills with ferromagnetic debris by measuring local variations in the earth's magnetic field caused by these objects.

The principle of operation of TDEM surveying is similar to that of frequency-domain surveying. The major difference is that in TDEM surveying, the transmitter generates a pulsed primary magnetic field, which induces eddy currents in nearby metallic objects. The eddy current decay produces a secondary magnetic field. By taking the measurement at a relatively long time after the start of the field decay, the current induced in the ground has fully dissipated, and only the current in the metal is still producing a secondary field. This secondary field is measured in the absence of the stronger primary field as a voltage in the receiver coil during this off time. This results in an enhanced signal response from buried targets, resulting in improved identification and excellent lateral resolution of those targets.

2.5.2.2.1 Introduction

The OU5 Work Plan specified the performance of surface geophysical surveys at IHSS 133, specifically magnetic and EM surveys. A trapezoidal area was evaluated at IHSS 133 with these geophysical surveys. The coordinates of the corners defining the trapezoidal area are as follows:

SW Corner: N747,220	E2,078,230
SE Corner: N747,220	E2,080,850
NE Corner: N748,100	E2,080,850
NW Corner: N747,620	E2,078,230

The survey area shown on Figure 7-2 in the OU5 Work Plan was reduced along the northern side because of geophysical interference by the chain link fence at the buffer zone perimeter and the Southern Pacific Railroad track which serves RFP. Within this trapezoidal area, a baseline parallel to and located approximately at N747,600 ft (Colorado State Plane Coordinates) was land surveyed and assigned a zero north-south coordinate. This baseline was marked by visible flagged stakes every 12.5 ft. Within this area, the magnetic and EM31 geophysical surveys used grid traverse lines running north to south and spaced 12.5 ft apart. The EM61 geophysical survey used resurveyed grid traverse lines spaced 5 ft apart, running north to south. The westernmost north-south grid traverse line located at E2,078,230 was assigned a zero coordinate, with all lines measured east of this baseline. Geophysical traverses were terminated along the south where the active channel of Woman Creek was encountered.

2.5.2.2.2 <u>Survey Procedures</u>

Trial survey traverses were made across OU5 from north to south using the magnetometer and EM instruments. Following these traverses, the data were reviewed to evaluate influence and intensity of known cultural features in order to characterize their responses.

The site selected for the fixed base station magnetometer was prescanned over a 25-foot radius to assure that no visible or buried ferromagnetic materials were present. This base station magnetometer is used to record the diurnal variations in the earth's magnetic field.

Grid traverse lines were followed during the geophysical surveys. Beginning at the north boundary line, southern traverses with the geophysical instruments were made along each grid traverse line bearing due south and controlled by compass. For the magnetic and EM31 geophysical surveys, instrument readings were recorded at each 10-foot division along the grid traverse line for total magnetic field intensity, magnetic gradient, vertical dipole conductivity (quadrature phase) component, vertical dipole in-phase component, horizontal dipole conductivity (quadrature phase) component, and horizontal dipole in-phase component along with grid traverse location coordinates. For the EM61 survey, instrument readings were recorded for time-domain EM conductivity at each 0.7-foot division along the grid traverse line, along with grid traverse location coordinates.

To assure reproducibility of the geophysical survey data recorded by the designated EM and magnetic instruments, field procedures given in Section 2.4.2.1.2 were implemented.

The data were analyzed using Geosoft computer software and contoured in color to generate the following maps:

- Total magnetic field,
- Magnetic gradient,
- Vertical dipole conductivity (quadrature phase),
- Vertical dipole in-phase,
- Horizontal dipole conductivity (quadrature phase),
- Horizontal dipole in-phase, and
- TDEM conductivity.

Conductivity and magnetic data were then interpreted using contour maps, profiles, and surface feature maps. The geophysical maps for IHSS 133 included in this TM are total magnetic field map (Figure 2.5.2.2-1), vertical dipole conductivity (quadrature phase) map (Figure 2.5.2.2-2), and time-domain EM conductivity maps (Figure 2.5.2.2-3). The other maps are not included because they offer little additional information. Results of the geophysical surveys are presented below in Section 2.5.2.2.3.

2.5.2.2.3 Results

Both the magnetometer and frequency-domain EM surveys were partially successful in characterizing or confirming the indicated locations of most of the IHSSs in the project area. Although the power line, which crosses the area from west to east, and a branch line, which turns to the north and is located just to the west of the Incinerator Site, did cause interference with the magnetic survey, reasonable magnetic data were acquired over the IHSSs that are located approximately 100 ft or more from the power lines.

The TDEM EM61 survey produced excellent good results. Anomalies (greater than 32 millivolts) resulting from surface and buried metallic objects are very prominent throughout IHSS 133 (Figure 2.5.2.2-3). The overhead power lines did not cause interference in this survey. Gaps in the TDEM survey data can be seen as blank areas on Figure 2.5.2.2-3. These are areas where data was unable to be acquired due to snow cover and steep slopes.

The geophysical survey results at the six individual sites within IHSS 133 are discussed in the following sections. Several more significant anomalous areas are not associated with known locations of the individual IHSSs.

One TDEM anomaly occurs approximately at coordinates 90S, 930E (north of the Concrete Wash Pad). A review of a 1951 aerial photograph (Figure 2.5.2.2-4) shows no evidence of a disturbed area, but one can be seen on 1953 and 1955 aerial photographs (Figures 2.5.2.2-5 and 2.5.2.2-6, respectively). This disturbed area is not visible on a 1962 photograph (Figure 2.5.2.2-7). A visual site inspection performed on March 15, 1994 revealed a depression of the same size and shape as the TDEM anomaly. This depression is approximately 1 to 2 ft deep. At the east end of the depression is a small mound 1 to 2 ft high. Further investigation of this site is warranted.

A second significant anomaly is located at coordinates 130S, 1065E (northeast of the Concrete Wash Pad). This cannot be seen on the 1951 aerial photograph (Figure 2.5.2.2-4), but is visible in 1953 (Figure 2.5.2.2-5). Aerial photographs from 1955 and later do not show the disturbed area. The site inspection on March 15, 1994 revealed surface metallic debris coinciding with the location of this anomaly.

The third TDEM anomaly occurs at coordinates 135N, 1455E (southeast of a small concrete pad). Prior to 1966, aerial photographs do not exhibit anything unusual. However, from 1967 to 1970 (Figure 2.5.2.2-8), a small round dark spot is evident southeast of and adjacent to this concrete pad. Visual inspection revealed an inconspicuous circular depression with some scattered metallic debris on the surface. Some further investigation may be desirable.

The fourth significant anomaly is located at coordinates 70S, 1550E (northwest of IHSS 133.3). A trench can be seen on aerial photographs from 1964 and 1965 (Figures 2.5.2.2-9 and 2.5.2.2-10, respectively) but is absent from photographs from 1966 (Figure 2.5.2.2-11) and later. The field inspection revealed an elongated mound, approximately 1 to 2 ft high, in the same shape and orientation as the TDEM anomaly. Further investigation of this site is warranted.

Various other smaller anomalies scattered throughout the area may be associated with either surface or buried metallic debris. All of these areas warrant further investigation as described in Section 3.2.2.1 of Volume 1.

IHSS 133.1. IHSS 133.1, previously mislocated near the concrete pad in the north-central par of the IHSS 133 area, consist of an elongated east-west trench due north of IHSS 133.3 (see Figure 1.2-3).

The magnetic data over IHSS 133.1 are unreliable due to powerline interference obscuring any magnetic anomalies. The EM survey data (Figure 2.5.2.2-2) exhibit moderate to high conductivity in the area coinciding with the IHSS 133.1 trench. This is interpreted to be related to the composition of the soils, which can vary from clay to gravel within the area, and their moisture content. The conductivity data do not delineate the trench location identified on aerial photographs (see Section 2.5.1), presumably because the material filling the trench and the soils surrounding the trench are probably similar in composition and moisture content.

The TDEM data show anomalous areas scattered throughout the central part of the trench (Figure 2.5.2.2-3). These data support the presence of buried metallic debris in the trench.

IHSS 133.2. An examination of a vertical aerial photograph taken on April 10, 1968, which was not available during preparation of the OU5 Work Plan, indicates that the initial IHSS 133.2 pit was approximately 150 ft in length and was probably partially buried at the time the 1968 photo was taken. Photographs from 1969 and later indicate the presence of a second pit south of the previously designated pit (Figure 2.5.2.2-8). Consequently, IHSS 133.2 has been expanded to include a previously undesignated area to the south of the power lines with approximately the same amount of disturbed surface area as indicated for the original 133.2 pit area (200 by 40 ft). The 1968 photograph further indicates that the pit was filled by direct dumping, and the material was not evenly distributed throughout the pit.

Although both the north and south areas are located within close proximity to the power lines, an anomalous magnetic low (approximately 54,300 gammas) occurs at approximately 50N, 2300E along the northern edge of the power line interference and coincides with the location of the north pit (Figure 2.5.2.2-1). Magnetic data over the south pit are obscured by the power line interference.

The vertical dipole conductivity data (Figure 2.5.2.2-2) show an anomalous high (approximately 64 mmhos/m) occurring approximately at coordinates 20S, 2325E, in the area between the north and south ash pits, flanked by conductivity lows (approximately 36 mmhos/m) corresponding to the location of the ash pits. The conductivity data seem to confirm the presence and location of these pits.

The TDEM data (Figure 2.5.2.2-3) show an anomalous area coinciding with the north trench at IHSS 133.2, most likely due to metallic debris buried in the trench. The TDEM data do not confirm the location of the southern trench. This trench probably does not contain metallic debris and is undetected by TDEM methods.

<u>IHSS 133.3</u>. The total magnetic field map (Figure 2.5.2.2-1) shows two magnetic highs (approximately 55,400 gammas) flanked by magnetic lows to the north along the edge of the power line interference, near coordinates 150S, 1700E to 1850E. These correspond to the

inferred location of the trench at IHSS 133.3. The configuration of the anomalies indicates that metallic debris may not have been uniformly distributed throughout the trench.

The EM survey data (Figure 2.5.2.2-2) show a broad area of relatively high conductivity located approximately from 0 to 300S and 1700E to 2100E. These data are interpreted to be related to the composition of the soils, which can vary from clay to gravel within the area, and their moisture content. The conductivity data may not delineate the trench as identified on the aerial photographs because the material filling the trench and the soils surrounding the trench are probably similar in composition and moisture content. Although the data failed to delineate the trench, the overall disturbed area can be readily identified on the ground.

The TDEM data do not delineate the trench location at IHSS 133.3 (Figure 2.5.2.2-3). The trench probably does not contain metallic debris and is undetected by TDEM methods.

<u>IHSS 133.4</u>. IHSS 133.4, a buried trench, has been expanded to include a possible disturbed area extending to the northeast from the trench area identified on vertical aerial photographs. The trench and disturbed area were measured on these vertical aerial photographs 180 by 40 ft and 190 by 40 ft. There were no photographs documenting the presence or size of trenches in the area while the trenches were in use.

A pronounced elongated magnetic anomaly located at coordinates 200S, 1212.5E coincides with the northern edge of IHSS 133.4 (Figure 2.5.2.2-1) and indicates the presence of magnetic debris within this east-west anomaly. Uniform distribution of metallic debris throughout the anomaly indicates that the trench location may be approximately 20 to 30 ft north of where it was assumed to exist. Power line interference obliterated all magnetic response over the northeast trench at IHSS 133.4.

The EM conductivity data (Figure 2.5.2.2-2) exhibit conductive lows (approximately 42 mmhos/m) in the areas approximately coinciding with the trench locations. The conductive lows are approximately 16 mmhos/m lower than local background values. The conductivity data do not appear to accurately delineate the trenches.

Results of the TDEM survey indicate the presence of buried metallic debris in the trenches at IHSS 133.4. An anomalous area approximately 100 by 50 ft occurs in the northeast portion of the northern trench. This may arise from buried metallic debris in this part of the trench.

An elongated anomalous area located at 200S, 1160E to 1270E appears to be buried metallic debris associated with the southern trench. These data support a change in the location of this trench to a position approximately 20 to 30 ft north of its present location.

IHSS 133.5. IHSS 133.5, the Incinerator, consists of a broad area covered with gravel and cement rubble piles with scattered metallic debris.

The magnetic data are questionable because of magnetic interference from the north-south power lines in this area. A magnetic low (approximately 54,400 gammas) is located at coordinates 50N, 1137.5E (Figure 2.5.2.2-1). This may be paired with a magnetic high directly to the west but obliterated by the power line interference, which is presumably associated with metallic debris in the concrete floor of the Incinerator.

IHSS 133.5 is not well delineated by the EM conductivity data. Conductivity changes in this area appear to coincide with changes in surficial geology. The Incinerator, however, is clearly seen on the EM conductivity map (Figure 2.5.2.2-2) at coordinates 90N, 1087.5E. The floor and foundation of the Incinerator occur as a rectangular-shaped low conductivity anomaly surrounded by a high conductivity halo.

TDEM data were not collected throughout most of this area, due to snow cover and steep slopes (Figure 2.5.2.2-3). However, an anomalous area can be seen in the northern part of IHSS 133.5, which may coincide with metallic debris at the Incinerator.

IHSS 133.6. IHSS 133.6 encompasses the Concrete Wash Pad area, which was active during the 1950s. The general configuration of the site was derived from vertical aerial photographs. This site is fairly large, and concrete appears to be thickest along the north side where trucks probably dumped concrete and were rinsed out.

The magnetic data show a strong magnetic anomaly (greater than 54,700 gammas) along the northern side of the area (Figure 2.5.2.2-1) near coordinates 140S, 900E. Continuing to the south, this anomaly grades into an area of lower magnetic intensity. The perimeter of the site exhibits background levels with no significant anomalies. The strong magnetic anomaly may be associated with power line interference or metallic debris that may have been buried or dumped along the northern half of the site.

The area is partially delineated by the EM survey. The vertical dipole conductivity map (Figure 2.5.2.2-2) shows an area of lower conductivity on the northern half of the site (near coordinates 140S, 900E) that may coincide with the area of thick concrete cover. This area of lower conductivity grades southward into an area of higher conductivity that may indicate alluvial sediments with increased moisture contents underlying the dump area.

The TDEM data do not delineate IHSS 133.6. This may arise from a lack of metallic debris in the area. A small (10 by 10 ft), localized anomaly, presumed to be associated with metallic debris, occurs approximately in the center of the area.

2.5.3 Stage 3

Stage 3 activities at the IHSS 133 sites included the collection of surface and subsurface soil samples in and around each IHSS. In addition, subsurface soil samples were collected from within an anomaly identified by the magnetic survey of the area.

2.5.3.1 Surface Soil Sampling

Surface soil sampling at IHSS 133 was specified by the OU5 Work Plan. The Work Plan specified that details of the surface soil sampling program be provided in a TM.

2.5.3.1.1 <u>Introduction</u>

The scope of work for the Stage 3 surface soil sampling program is described in TM4. TM4 was approved by CDH in a letter dated April 9, 1993 (CDH, 1993) and by EPA in a letter dated April 13, 1993 (EPA, 1993).

Two phases of surface soil sampling were proposed in TM4. The first phase of sampling proposed to identify elevated concentrations of metals and polynuclear aromatic hydrocarbons (PAHs), and to confirm the results of the initial HPGe survey for radionuclides in surface soils within the IHSS 133 area. The second phase of sampling proposed to assess areas of elevated radioactivity that were identified after a second radiation survey of IHSS 133 was completed.

Phase 1 of the surface soil sampling plan used judgmental sampling methods in combination with random sampling methods to bias the samples and improve detection of contaminants. Of the 18 samples, seven were biased by collecting them downwind of the identified IHSSs in the 133 area. Analysis of an RFP wind rose diagram indicates that the primary wind direction is from the west-northwest. Based on this information, one surface-soil sample was collected approximately 50 ft directly east-southeast from a point on the southeast border of each of the identified IHSSs. The remaining 11 samples were randomly collected throughout the IHSS 133 area to evaluate potential windborne contamination from the incinerator stack, ash pits, and ash pit delivery routes. Eleven grid points were used from the completed HPGe survey of the IHSS 133 area and were randomly selected using a random number generator. The grid intersections are the sampling locations.

Radiological surveys of IHSS 133 were ongoing at the same time that Phase 1 soil sampling was conducted. The results of the radiation surveys are discussed in Section 2.5.2.1 of this document. These results were used to design the Phase 2 surface soil sampling plan to characterize the radiation anomalies. One radiation anomaly was identified and a profile sample was collected from this location, and a second profile sample was collected from another radiation survey location that was not anomalous.

2.5.3.1.2 <u>Sampling Procedures</u>

Sample locations were identified in the field by means of a compass, measuring tape, and surveyed markers installed as part of the radiation survey and ash pit field location activities. The location of each random sample was staked at the time the sample was collected. The field procedures used to collect surface soil samples are specified in SOP GT.08. Samples collected for both radiological and conventional analyses were collected according to the RF method, Section 5.0 of SOP GT.08. The RF method is described in Section 2.4.3.1.2.

Profile samples were collected in accordance with SOP GT.08, as amended by DCN 93.02. Profile sampling obtains three discrete soil samples from depths up to 6 inches, and each discrete sample is representative of soil over an interval of 2 inches in depth. For example, the first interval extends from the ground surface to 2 inches deep, the second interval is from 2 to 4 inches deep, and the third interval is from 4 to 6 inches deep. Profile samples were collected from the ground surface downward in 2-inch increments as described above using a stainless steel trowel. Sufficient material was collected to fill a 500 milliliter container.

One of the profile samples was collected at HPGe survey station F10 (Figure 2.5.3.1-1) where uranium-238 activity as measured by the HPGe ranged from 18.8 to 21.7 pCi/g. The second profile sample was collected at HPGe survey station B17, which was not anomalous for any of the radionuclides counted by the HPGe (Figure 2.5.3.1-1).

2.5.3.1.3 Results

Surface soil samples were collected at 20 locations in IHSS 133 (Figure 2.5.3.1-1). Eighteen of the samples were analyzed for TAL metals, radionuclides, TOC, and PAHs. The two profile samples were collected at HPGe stations B17 and F10 and were analyzed only for radiological parameters. Two sediment samples were collected form seeps and analyzed for TAL metals, radionuclides, pesticides, PCBs, SVOCs, and VOCs. The analytical results available as of January 28, 1994 are discussed below. Table 2.5.3.1-1a-b presents a summary of analytes present in concentrations exceeding BUTLs for these samples.

Metals. Out of the 18 samples collected, the BUTLs were exceeded in one surface soil sample for zinc and one for silver (Table 2.5.3.1-1a). Both sediment samples from IHSS 133 exhibited zinc exceeding the BUTL and antimony exceeded the BUTL in one of these samples (Table 2.5.3.1-1b). Their locations are shown on Figure 2.5.3.1-2.

Radionuclides. Data for samples collected at the two HPGe stations were not available in RFEDS as of January 28, 1994. Of the 17 acceptable analyses for the random and biased surface soil samples, gross alpha, uranium-233/234, and uranium-238 were detected in concentrations exceeding BUTLs in one, seven, and 14 samples, respectively (Table 2.5.3.1-1a). One of the sediment samples exhibited uranium-238 exceeding the BUTL (Table 2.5.3.1-1b). The surface soil and sediment sample locations where BUTLs were exceeded are shown in Figure 2.5.3.1-3.

Polynuclear Aromatic Hydrocarbons. None of the surface soil samples or sediment samples exhibited detectable concentrations of PAHs.

Semi-Volatile Organic Compounds. Surface soils were not analyzed for SVOCs. The SVOC bis(2-ethylhexyl)phthalate was detected in one of the sediment samples (Table 2.5.3.1-1b). Figure 2.5.3.1-4 shows the location of this sample.

Volatile Organic Compounds. Surface soils in IHSS 133 were not analyzed for VOCs. Sediment samples did not contain detectable concentrations of VOCs.

General Chemistry Analyses. Surface soil samples collected in IHSS 133 were analyzed for TOC. Analytical results for these samples are included in Appendix B.6.

Per TM4, it was agreed that the number of acceptable surface soil samples would be compared to EPA performance measures. TM4 specified that after the sample data were reported, the coefficient of variations (CVs) would be calculated to determine if EPA performance criteria had been achieved, as demonstrated by a CV equal to or less than 40 percent.

CVs for the following metals exceeded 40 percent: cadmium, calcium, copper, magnesium, nickel, silver, sodium, strontium, tin, and zinc. Copper and magnesium only slightly exceed the target CV, with CVs of 43 and 46 percent, respectively. Therefore, there is no need for additional sampling to support risk assessment for these metals. Calcium, magnesium, sodium, and zinc are essential nutrients, are nontoxic at maximum concentrations measured at IHSS 133, and do not warrant additional sampling. Of the remaining metals, only cadmium is of interest in terms of human health risk assessment. The existing sample numbers, however, are sufficient for use in risk assessment. In addition, one-half of the samples (10 of 20) were non-detects (at a detection limit of 1 mg/kg).

CVs for the following radionuclides also exceeded 40 percent: americium-241, plutonium-239/240, and uranium-235. The highest CV was 57 percent for plutonium-239/240. CVs for americium-241 and uranium-235 were 44 and 49 percent, respectively. However, additional sampling to meet a target CV of 40 percent is not necessary to support risk assessment for the following reasons:

- Existing samples were collected using random and biased methods. Biased locations were based on historical information and Stage 2 survey results. Therefore, it is likely that the data are conservatively representative of the sampled area.
- Comparisons with background soil concentrations (the Rock Creek 18 samples) show that the maximum concentrations from IHSS 133 (exclusive of the known hot spot at HPGe station F10) are lower than BUTLs for americium-241 and plutonium-

239/240 and equal to the BUTL for uranium-235. The absence of any elevated concentrations would also indicate that there is no need for additional sampling.

2.5.3.2 Soil Borings

The OU5 Work Plan specified that soil borings be drilled into each identified pit to characterize cover and subsurface materials. The Work Plan further specified that the soil boring program be presented in TM for review by EPA and CDH prior to implementation. TM7 described the soil boring program for the IHSS 133 sites and was reviewed and approved by EPA and CDH.

2.5.3.2.1 Introduction

Per TM7, soil borings were installed as part of the OU5 Phase I RFI/RI in the areas of the Ash Pits (IHSSs 133.1 through 133.4), the Incinerator (IHSS 133.5), and the Concrete Wash Pad (IHSS 133.6) (Figure 2.5.3.2-1).

Soil borings were drilled to geologically and chemically characterize the cover and subsurface materials within and/or downgradient of the Ash Pits, Incinerator, and Concrete Wash Pad areas. They were also drilled to characterize the contamination sources at IHSS 133, to determine the locations of the Ash Pits, and to assist in assessing the lateral and vertical extent of the Ash Pits. Additionally, the installation of the soil borings was intended to provide information as to the existence of contaminants within the Ash Pits. If contaminants were present, installation of soil borings would help to determine if these contaminants had leached into the soils and/or groundwater beneath or downgradient of the Ash Pits.

Further, these borings were intended to determine if groundwater was present and, if so, at what depth (i.e., is the groundwater flowing through the ash materials within the Ash Pits). If groundwater was present, a groundwater sample was collected from the soil borings. The data collected from the groundwater samples was used to assess if contaminants had reached the water table from the Ash Pits, Incinerator, and/or Concrete Wash Pad areas.

The OU5 Work Plan (DOE, 1992a) proposed placing borings on 25-foot centers that transect each IHSS in order to delineate the boundaries of the Ash Pits. The FSP also stipulated that if the boundaries of IHSS 133 could be determined by aerial photography review, radiological survey, and/or the proposed geophysical surveys, fewer soil borings would be necessary. As discussed in Sections 2.5.1 and 2.5.2.2, the aerial photograph review and geophysical surveys resulted in modifications to the boundaries of these IHSSs.

Based on the results of the aerial photograph review and geophysical survey results, TM7 proposed a soil-boring program that included drilling 28 borings and an undesignated number of shallow offset borings to be used in locating the Ash Pit(s). TM7 also proposed placing a soil boring in the central location of any anomalous areas detected by the HPGe survey. Eighteen borings were to be placed on 50- to 100-foot centers along the long axes of IHSSs 133.2 through 133.4 (Figure 2.5.3.2-2). Four borings were to be placed in IHSS 133.5 in the approximate area of the Incinerator, to the southwest of the Incinerator, and to the southeast of the Incinerator. One boring was to be placed in the area shown as IHSS 133.1 in the OU5 Work Plan to determine the presence of an ash pit at this location (see Section 2.5.1). Three borings were to be placed downgradient of IHSS 133.6 on 100-foot centers. Also, two borings were proposed for investigation of the "pit and disturbed area" northeast of IHSS 133.2.

The completed soil-boring program included the installation of 53 soil borings. Two of these borings were placed in a hot spot that was detected during the HPGe survey. Six of the borings drilled in this IHSS were originally intended to be wells as part of the groundwater investigation; however, no groundwater was encountered during drilling, and the wells were abandoned and reclassified as boreholes (Section 2.5.4.1). Seventeen borings were 10- to 12-foot deep offsets, as described in TM7. The remaining 28 borings were drilled in the locations specified in TM7 (Figure 2.5.3.2-3).

The soil borings, with the exception of the shallow offsets, were drilled 6 ft into weathered bedrock in accordance with the OU5 Work Plan (DOE, 1992a) and TM7 (EG&G, 1993f). If the bedrock encountered was a sandstone, the borings were advanced 6 ft into the next claystone horizon. Occasionally, a claystone was encountered that would not allow advancement for the full 6 ft into bedrock. In these cases, the borings were advanced to refusal.

2.5.3.2.2 Drilling and Sampling Procedures

Hollow-stem augers were used for advancing the boreholes using the techniques described in SOP GT.02. Samples were collected with a split-spoon sampler. Once the drive sampler was removed from the borehole and opened, its contents were scanned with an alpha and a beta/gamma probe to detect radioactivity, and an OVM to detect VOCs. The amount of recovered core was then measured, examined visually for the presence of waste material, and the lithology was classified and logged.

Soil samples were continuously collected from ground surface to the first bedrock interval. Six-foot composite samples were collected and analyzed for TAL metals, total uranium, plutonium, americium, gross alpha, and gross beta as specified in the OU5 Work Plan (DOE, 1992a) and

TM7 (EG&G, 1993f). In order to obtain these 6-foot composite samples of soil core, the recovery was placed in a safe location, out of direct sunlight, until three consecutive 24-inch, or four consecutive 18-inch samples, totaling the required 6 ft were collected. Soil from the 6-foot interval was then mixed into a composite sample and placed in appropriate containers for laboratory analysis according to SOP FO.13.

In accordance with TM7 (EG&G, 1993f), an alternative sample collection method was followed when it was possible for the site geologist to determine a distinct visible lithologic difference between natural geologic materials, artificial fill, and ash material. When this distinction could be made, separate composite samples were made up of natural geologic materials/artificial fill, and ash materials.

In addition to the 6-foot composite samples, 2-foot composite samples were collected from the top 2 ft to assist in the ecological assessment study. These samples were analyzed for the same constituents as listed above. Also, 11 soil samples were collected from the IHSS 133 borings for geotechnical analysis (i.e., grain size).

TM7 specified that when groundwater was encountered, groundwater samples be collected at a frequency of one per IHSS, one per covered trench or pit associated with an IHSS, and one for the pit and disturbed area east of IHSS 133.2. Four unfiltered groundwater samples were collected with the Hydropunch II® sampler in accordance with SOP GW.06. The groundwater samples were analyzed for the same analytes as the soil samples (TAL metals, total uranium, plutonium, americium, gross alpha, and gross beta). In addition, pH, specific conductance, temperature, and dissolved oxygen were measured at the time of sample collection.

2.5.3.2.3 Results

The completed soil boring program for IHSS 133 included the installation of 53 soil borings in accordance with TM7, plus additional borings originally intended to be wells (Figure 2.5.3.2-3). As stated in the previous section, most of the borings, with the exception of the shallow offsets, were drilled 6 ft into weathered bedrock as proposed in TM7 (EG&G, 1993f). Three exceptions included borehole 57493 (located in the pit and disturbance area), and boreholes 57093 and 57293 (located in IHSS 133.2). Borehole 57493 encountered a clayey sandstone from 20 to 24 ft; therefore, it was drilled to a total depth of 30 ft (6 ft below the sandstone layer). Boreholes 57093 and 57293 each reached refusal, so they could not be advanced for the full 6 ft.

The analytical results for the soil samples collected from the boreholes installed in the IHSS 133 area included only radionuclide constituents and TAL metals. VOCs and SVOCs were not analyzed for, because the waste disposed of in the Ash Pits had been incinerated prior to disposal and any VOCs or SVOCs would have been destroyed during incineration.

IHSS 133 has been divided into seven different areas of investigation, and the investigation for each area will be discussed individually in the following paragraphs.

Area Previously Designated as IHSS 133.1. Borehole 56193 (Figure 2.5.3.2-3) was drilled to a depth of 34 ft directly in the center of the area designated as previously identified as IHSS 133.1 in the OU5 Work Plan. This borehole did not encounter ash material or groundwater (Table 2.5.3.2-1). Bedrock was encountered in the depth interval from 26.4 to 28 ft and was described as claystone. The absence of ash material at this location indicates that no ash pit exists within this area. No shallow offset borings were drilled in this area.

During the drilling of this borehole, field monitoring, as described in Section 2.5.3.2.2, was conducted on the core. The monitoring results from the OVM, the alpha and beta/gamma probes, and radiation smears were all below background levels.

Based on the laboratory results of the soil samples collected at this location, there were no radionuclide constituents or metal constituents detected at concentrations greater than background levels. These results along with visual inspection of drill core indicate that an ash pit does not exist in this area. The TDEM survey performed after the drilling program, however, indicates the presence of an anomaly southwest of the borehole location adjacent to the concrete pad (see Section 2.5.2.2.3). The location of this anomaly warrants additional investigation (see Section 3.2.2.1 of Volume 1).

IHSS 133.2. IHSS 133.2 includes the original ash pit shown in the OU5 Work Plan (DOE, 1992a) and a second trench located to the south of the ash pit as shown in Figure 2.5.3.2-1. Six deep boreholes and three shallow offset boreholes were drilled in IHSS 133.2 (Figure 2.5.3.2-4). The six deep boreholes, 56893 through 57393, were drilled to depths ranging from 18.5 to 37.1 ft (Figures 2.5.3.2-5 and 2.5.3.2-6, and Table 2.5.3.2-1). The alluvial thicknesses encountered in these boreholes ranged from 12.5 to 34.1 ft (Table 2.5.3.2.3-1). Three shallow offset boreholes (57293A, 57293B, and 57293C) were drilled in an attempt to locate the southern pit. These were drilled offset from the proposed location of borehole 57293 and terminated at a depth of 12 ft. Since no ash material or bedrock were encountered in these borings, the originally staked location for borehole 57293 was drilled.

Two boreholes, 56893 and 56993, located at the western end and center of the original (north) ash pit, encountered ash and incinerator residue in the depth intervals from approximately 2 to 8 ft and 8 to 9 ft, respectively (Figure 2.5.3.2-5 and Table 2.5.3.2-1). The incinerator residue material in borehole 56893 was described on field logs as ash, charcoal, and material that appeared to be glass and metal pieces the size of sand grains. The material in borehole 56993 was described on field logs as styrofoam, white fiber material, charcoal, and gray ash. None of the other numbered or exploratory boreholes within the designated IHSS 133.2 area encountered ash.

A geotechnical sample was collected at borehole 56993 from the depth interval of 0 to 2 ft and analyzed for particle size. Appendix E, Figures E9 through E20 present the results of the geotechnical analyses that were performed on the boreholes located in IHSS 133. The results of the analysis of the sample collected from borehole 56993 (Figure E18) indicate that the alluvial material was fairly well graded, with most of the sample being on the coarser side. Thirty-three percent of the sample was gravel (i.e., retained on the #4 sieve), 35.4 percent of the sample was sand (i.e., passed through the #4 sieve but retained on the #200 sieve), and 31.3 percent of the sample was silt/clay (i.e., passed through the #200 sieve). Based on these percentages, the sample has been classified as a SM/SC using the USCS.

Groundwater was encountered in boreholes 56993, 57093, and 57393 (Figures 2.5.3.2-5 and 2.5.3.2-6). Approximate depths to groundwater ranged from 12 to 25 ft (Table 2.5.3.2-1). The depth of the waterbearing zone in borehole 57393 is unknown, as water was not detected until abandonment procedures took place. It is assumed that the water came from a gravelly layer just above the bedrock at a depth of 23 ft. A groundwater sample was collected from borehole 56993 at a depth of 24 to 26 ft. The analytical results of this sample are included in the summary in Table 2.5.3.2-2. As shown in this table, the laboratory analysis results of groundwater samples indicate the presence of radionuclides and metals in concentrations exceeding BUTLs.

Metals. There were a number of metals that were detected in the groundwater samples at concentrations exceeding the BUTLs. As presented on Table 2.5.3.2-2, these constituents include mercury, aluminum, barium, beryllium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, vanadium, and zinc. All of these constituents were detected at concentrations that exceed the maximum background concentrations with the exception of lead and zinc.

Radionuclides. The radionuclides detected at concentrations exceeding BUTLs in groundwater samples included americium-241, gross alpha, gross beta, plutonium-239/240, radium-226, uranium-233/234, uranium-235 and uranium-238 (Table 2.5.3.2-2).

During the drilling of these boreholes, field monitoring, as described in Section 2.5.3.2.2, was conducted on the core. At borehole 56893, beta/gamma activity was detected at 1,000, 1,100, and 800 cpm at depth intervals from 4 to 6 ft, 6 to 8 ft, and 8 to 10 ft, respectively. Also, alpha activity of 21.3 disintegrations per minute per 100 square centimeters (dpm/100 cm^2) and 23.8 dpm/100 cm^2 was detected on radiation smears of samples taken from depth intervals from 4 to 6 ft and 6 to 8 ft, respectively. The remainder of the monitoring results from the OVM, the alpha and beta/gamma probes, and radiation smears were all below background levels.

Analytical results of the constituents detected at concentrations exceeding BUTLs from the soil samples collected from boreholes 56893 through 57393 are summarized on Table 2.5.3.2-3. As mentioned above, the analytical results for the soil samples collected from boreholes installed in the IHSS 133 area included only radionuclides and TAL metals. The results for the borehole soil samples are summarized in the following two paragraphs and then discussed in detail for each IHSS.

Metals. As presented on Table 2.5.3.2-3 and on Figure 2.5.3.2-7, the metals analyses detected antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, manganese, molybdenum, nickel, silver, and zinc, at concentrations exceeding BUTLs. A total of one antimony, one arsenic, two barium, one beryllium, three cadmium, one chromium, one cobalt, three copper, two manganese, one molybdenum, one nickel, two silver, and two zinc results were at concentrations greater than BUTLs. These results also indicated that the arsenic, cobalt and manganese results were present at concentrations below the maximum background concentrations. Also, two of the samples that contained barium concentrations greater than the BUTL and one of the samples that contained copper concentrations greater than the BUTL were present at concentrations below the maximum background concentrations. The results of the samples that detected metal constituents at concentrations greater than maximum background concentrations were all from soil samples collected from boreholes 56893 and 56993 at depths ranging from 2 to 8.8 ft and 4.9 to 8.1 ft, respectively.

Radionuclides. As presented on Table 2.5.3.2-3 and on Figure 2.5.3.2-8, the radiological analyses detected americium-241, gross alpha, gross beta, plutonium-239/240, and total uranium greater than BUTLs. These constituents were detected from soil samples collected from boreholes 56893 through 57393. A total of two americium-241, two gross alpha, four gross beta, two plutonium-239/240, three uranium-233/234, four uranium-235, and 11 uranium-238 results were detected at activities exceeding BUTLs. These results also indicated that one of the samples contained an uranium-235 activity greater than the BUTL, and eight of the samples with uranium-238 exceeding the BUTL were at concentrations below the maximum background concentrations. The results of the samples that are greater than maximum background concentrations were all from soil samples collected from a depth of 0 to 8.8 ft. Therefore, it appeared that radiological contamination exceeding maximum background concentrations was not present below approximately 9 ft.

IHSS 133.1 and IHSS 133.3. The area designated as IHSS 133.3 has been modified to include two trenches within the IHSS boundary (Figure 2.5.3.2-1). As discussed in Section 2.5.1, this area includes a northern trench, IHSS 133.1, and a southern trench, IHSS 133.3.

Six deep boreholes (56293 through 56793) and six shallow offset boreholes were drilled in IHSSs 133.1 and 133.3. The six shallow offset boreholes were drilled in an attempt to more accurately locate the trenches, and the deep borings were drilled within the trenches to characterize the cover and subsurface materials. The three shallow offset boreholes drilled in IHSS 133.3 (56693A, 56693B, and 56693C) were drilled to a depth of 4 ft and encountered bedrock at a depth of approximately 3.5 ft. None of these boreholes encountered waste. Therefore, the three deep boreholes (56593 through 56793) were drilled in the originally proposed locations. Figure 2.5.3.2-9 shows the lithology encountered in the deep boreholes. No groundwater or ash material was encountered in these boreholes. Table 2.5.3.2-1 shows the total depths of the boreholes drilled in IHSS 133.3 ranged from 4 to 19 ft. The thickness of alluvium ranged from 2.0 to 13.6 ft (Figure 2.5.3.2-9).

Of the three shallow offset boreholes located in IHSS 133.1 (56393A, 56393B, and 56393C), borehole 56393C was the only one that encountered waste material. This material was collected from the depth interval of 3 to 5 ft. It was described on the field log as sand with burned wood fragments. Field radiation surveys detected radiological activity well exceeding background in this sample. Since the presence of waste was confirmed with this sample, this exploratory borehole was abandoned at 5 ft. Prior to grouting, a static water level was noted in the boring at a depth of approximately 0.5 ft.

Borehole 56393 was drilled approximately 5 ft west of exploratory borehole 56393C. Borehole 56393 encountered incinerator residue in the depth interval from 2 to 5 ft, and groundwater from depths of approximately 0.5 to 5 ft (Figure 2.5.3.2-10). The incinerator residue was described on the field log as fine- to medium-grained sand with glass, burned material, and rust. None of the other boreholes within the area designated as IHSS 133.1 encountered either ash or groundwater (Table 2.5.3.2-1). Table 2.5.3.2-1 shows that the total depths of the deep boreholes ranged from 9 to 19 ft. The bedrock material encountered at these locations was claystone and silty claystone. The thickness of the alluvium ranged from 3.0 to 6.9 ft (Figure 2.5.3.2-10).

A groundwater sample was collected from borehole 56393 at a depth of 6 to 8 ft. The results of the analysis performed on this sample that exceed BUTLs are included on Table 2.5.3.2-2. As shown in this table, the results of the laboratory analysis of groundwater samples indicate the presence of radionuclides and metals.

The radionuclides detected at concentrations exceeding BUTLs included americium-241, plutonium-239/240, uranium-233/234, uranium-235, uranium-238, gross alpha, and gross beta. All of these constituents were detected at concentrations that also exceed the maximum background concentrations.

There was also a number of metals that were detected at concentrations exceeding the BUTLs. As presented on Table 2.5.3.2-2, these constituents include barium, beryllium, cadmium, chromium, copper, manganese, nickel, potassium, silver, and zinc. All of these constituents were detected at concentrations that exceed the maximum background concentrations with the exception of nickel and potassium.

During the drilling of these boreholes, field monitoring, as described in Section 2.5.3.2.2, was conducted on the core. The core collected from borehole 56393 was the only core from which readings exceeding background levels were detected. At borehole 56393, beta/gamma was detected in the field at 2,000, 11,000, 2,000, 2,100, 850, and 250 cpm at depth intervals of from 0 to 2, 2 to 4, 4 to 6, 6 to 8, 8 to 10, and 10 to 12 ft, respectively. Also, alpha activity was detected on radiation smears of the samples ranging from 43.84 to 307.94 dpm/100 cm^2 at a depth interval of 2 to 6 ft. Beta/gamma activity was detected on radiation smears of the samples ranging from 788.61 dpm/100 cm^2 to 3,727.64 dpm/100 cm^2 at the same depth interval. Also, radiation smears of samples taken from the 8- to 10-foot interval detected beta/gamma activity at 434.9 dpm/100 cm^2, and radiation smears of samples taken from the 10- to 12-foot interval detected alpha activity at 69 dpm/100 cm^2. The rest of the monitoring results from the OVM, the alpha and beta/gamma probes, and radiation smears were all below reportable limits.

Analytical results of the constituents detected at concentrations exceeding BUTLs from the soil samples collected from boreholes 56293 through 56793 are presented on Table 2.5.3.2-3. A summary of these results is discussed below.

Metals. As presented on Table 2.5.3.2-3 and Figure 2.5.3.2-7, one barium, one cadmium, one cobalt, three copper, one silver, and one zinc results were detected at concentrations greater than BUTLs. These results also indicated that the barium and cobalt results were at concentrations below the maximum background concentrations. Also, one of the samples that detected copper exceeding BUTLs was at a concentration below the maximum background concentrations. The results of the samples that are greater than maximum background concentrations were all from soil samples collected from borehole 56393 at depths ranging from 0 to 6 ft. Therefore, it appears that all of the metals contamination detected exceeding maximum background concentrations is not present below the depth of approximately 6 ft.

Radionuclides. As presented on Table 2.5.3.2-3 and Figure 2.5.3.2-8, the radiological analyses detected americium-241, gross alpha, gross beta, plutonium-239/240, and total uranium at concentrations exceeding BUTLs and maximum background concentrations. A total of three americium-241, two gross alpha, three gross beta, two plutonium-239/240, three uranium-233/234, four uranium-235, and five uranium-238 results were detected at concentrations exceeding BUTLs. These results also indicated that one of the samples that detected uranium-233/234 exceeding BUTLs, and two of the samples that detected uranium-238 exceeding BUTLs were at concentrations below the maximum background concentrations. The results of the samples that are greater than maximum background concentrations were all from soil samples collected from boreholes 56293, 56393, 56593, and 56793 and from depths ranging from 0 to 8 ft, except one sample that was collected from a depth of 6 to 12 ft from borehole 56793.

IHSS 133.4. The boundary of the area designated as IHSS 133.4 has been expanded to include an apparent disturbed area extending to the northeast from the original trench area (Figure 2.5.3.2-1). The sizes of the two areas were estimated to be 180 by 40 ft and 190 by 40 ft, respectively.

Six deep boreholes (55593 through 56093) and eight shallow offset boreholes were drilled within the area designated as IHSS 133.4. The shallow offset borings were drilled again in an attempt to more accurately define the location of the ash pit prior to drilling the deep boreholes.

The eight shallow offset boreholes were drilled to a depth of 12 ft, with the exception of borehole 55693A, which was drilled to a total depth of 18 ft (Table 2.5.3.2-1). Neither bedrock nor groundwater was encountered in these boreholes. Waste material was encountered in one of the shallow offset boreholes (55793A). This borehole was offset approximately 12 ft to the north of borehole 55793 and encountered asbestos-containing material (ACM) at a depth of 5 to 7 ft (Figure 2.5.3.2-11).

The deep boreholes were drilled to depths of 8 to 30 ft and encountered alluvial thicknesses ranging from 4.2 to 24 ft (Table 2.5.3.2-1 and Figure 2.5.3.2-11). Groundwater was not encountered in any of the boreholes drilled in this IHSS. Borehole 55993, located in the center of the northeastern trench, encountered incinerator residue in the depth interval from 2.3 to 9.3 ft (Figure 2.5.3.2-10). This incinerator residue was described on the field log as ash-containing glass, metal turnings, and other metallic objects. Borehole 55693 also encountered a small amount of material that was described as "possibly ash" at a depth of 15.5 ft below. None of the remaining boreholes within the designated IHSS 133.4 area encountered ash.

Soil samples were collected for geotechnical analysis (i.e., particle size analysis) from boreholes 55593, 55693, 55793, and 55893. These samples were collected from 0 to 2 ft. The results of these analyses, are presented in Appendix E, Figures E14 through E17. These results indicate that the surface soil in this area displays similar grain size distributions between samples. The alluvial material was not well-graded, and most of the material from the samples are clays and silts (i.e., passed through #200 sieve). Samples collected from these boreholes had silt/clay percentages ranging from 63.7 to 75.6 percent. Based on these percentages, all of the samples have been classified as inorganic silts/inorganic clays (ML/CL) using the USCS. Since the analyses performed did not include Atterberg Limits or plasticity analysis to determine silt versus clay percentages, these samples cannot be classified more specifically.

During the drilling of these boreholes, field monitoring, as described in Section 2.5.3.2.2, was conducted on the core. The core collected from borehole 55993 was the only core from these boreholes from which readings exceeding background levels were detected. At borehole 55993, beta/gamma was detected in the field at 1,200 and 2,500 cpm on samples taken from 2 to 4 and 4 to 6 ft, respectively. The radiation smears of these samples, however, did not detect activity greater than background levels. The rest of the monitoring results from the OVM, the alpha and beta/gamma probes, and radiation smears were all below reportable limits.

Analytical results of the constituents detected at concentrations exceeding BUTLs from the soil samples collected from boreholes 56293 through 56793 are presented on Table 2.5.3.2-3.

Metals. As presented on Table 2.5.3.2-3 and Figure 2.5.3.2-7, the metals analyses detected two barium, two cadmium, one cobalt, two copper, one iron, one nickel, one potassium, two silver, one tin and two zinc results were detected at concentrations exceeding BUTLs. These results also indicated that the barium, cobalt, iron, nickel, and potassium results were at concentrations below the maximum background concentrations. Also, the analysis of the rinsate sample that was collected from borehole 55993 indicated that iron and zinc were detected at concentrations of 160 and 14.3 μg/L, respectively. The results of the samples that exceed maximum background concentrations were all from soil samples collected from borehole 55993 at depths from 0 to 6 and 5.3 to 9.3 ft.

It appears that all of the metals contamination detected exceeding BUTLs and maximum background concentrations is present down to a depth of approximately 9.3 ft.

Radionuclides. As presented on Table 2.5.3.2-3 and Figure 2.5.3.2-8, the radiological analyses detected americium-241, gross alpha, gross beta, plutonium-239/240, and total uranium at concentrations exceeding BUTLs and background concentrations. A total of one americium-241, two gross alpha, two gross beta, four plutonium-239/240, two uranium-233/234, two uranium-235, and seven uranium-238 results were detected at concentrations exceeding BUTLs. These results also indicated four of the samples that contained uranium-238 exceeding BUTLs were at concentrations below the maximum background concentrations. All the results exceeding maximum background concentrations were from soil samples collected from boreholes 55793 and 55993 at depths ranging from 0 to 9.3 ft, with the exception of one sample that was collected from a depth of 8 to 12 ft. The deeper sample was collected from borehole 56093 and contained plutonium-239/240 exceeding background concentrations (Figure 2.5.3.2-8).

IHSS 133.5. The area designated as IHSS 133.5 includes the Incinerator Site. The area is covered with gravel and cement rubble piles with scattered metallic debris. Vertical and oblique aerial photographs taken in 1966 show the Incinerator while it was in operation. Its approximate location has been plotted on Figure 2.5.3.2-1. Anomalies occurring on the EM survey maps coincide with the plotted location of the Incinerator, which indicates that the foundation and floor of the Incinerator were left in place when it was demolished. The magnetometer data did not fully delineate the site, but contained some weak anomalies that may correspond to the buried foundation.

Two deep boreholes were drilled in the area designated as IHSS 133.5 (55393 and 55493) and two were drilled downslope of IHSS 133.5 (55193 and 55293) (Figure 2.5.3.2-3). As shown on Table 2.5.3.2-1 and Figure 2.5.3.2-12, these boreholes were drilled from 12 to 36.2 ft with bedrock encountered at depths ranging from 6 to 32.8 ft. Two of the deep boreholes (55393 and 55493) were located on the north side higher up on the slope (Figure 2.5.3.2-3). Of the four boreholes that were drilled in the vicinity of this IHSS, only one borehole (55393) encountered material that may have been ash. This finding, however, is questionable due to the depth at which it was found (15.9 ft), its location, and its lack of detectable radioactivity exceeding background. None of the boreholes drilled in or adjacent to the area designated as IHSS 133.5 encountered groundwater.

Soil samples were collected for geotechnical analysis (i.e., particle size analysis) from each borehole from a depth of 0 to 2 ft. The results of these analyses, are presented in Appendix E, Figures E10 through E13. These results indicate a wide range in alluvial material size. The results of the analysis run on the sample collected from borehole 55193 (Figure E10) indicate that the alluvial material was fine grained (i.e., 63.2 percent of the sample passed through the #200 sieve). Only 4.7 percent of the sample was gravel (i.e., retained on the #4 sieve), and 32.1 percent of the sample was sand (i.e., passed through the #4 sieve but retained on the #200 sieve). Based on these percentages, the sample has been classified as a ML/CL, using the USCS.

The results of the geotechnical analyses run on the samples collected from boreholes 55293 and 55393 (Figures E11 and E12) indicated that the alluvial material was coarse grained (i.e., 36.6 and 49.6 percent of the samples were retained on the #4 sieve, respectively). Also, the samples collected from boreholes 55293 and 55393 had 33 and 19.4 percent silt/clay (i.e., passed through the #200 sieve), respectively. Based on these percentages, these samples have been classified as GM/GC, using the USCS.

The results from the geotechnical analysis run on the sample collected from borehole 55493 indicated the sample to be well-graded sand (SW) using the USCS. The sample consisted of 23.1 percent gravel (i.e., retained on the #4 sieve), 72.6 percent sand (i.e., passed through the #4 sieve but retained on the #200 sieve), and only 4.3 percent silt/clay (i.e., passed through the #200 sieve).

During the drilling of these boreholes, field monitoring, as described in Section 2.5.3.2.2, was conducted on the core. All of the monitoring results from the OVM, the alpha and beta/gamma probes, and radiation smears were below background levels.

Analytical results of the constituents detected at concentrations exceeding BUTLs from the soil samples collected from boreholes 55193 through 55493 are presented on Table 2.5.3.2-3.

Metals. As presented on Table 2.5.3.2-3 and Figure 2.5.3.2-7, one barium, one copper, and two manganese results were detected at concentrations exceeding BUTLs. These results also indicated that the barium and manganese results were at concentrations below the maximum background concentrations. The results of the sample that detected copper exceeding maximum background concentrations was from a soil sample collected from borehole 55193 at depths of 6 to 8 ft. From these results, it appears that there is no metals contamination at this site.

Radionuclides. As presented on Table 2.5.3.2-3 and Figure 2.5.3.2-8, the radiological analyses detected americium-241, plutonium-239/240, and uranium-238 at concentrations exceeding BUTLs. A total of three americium-241, one plutonium-239/240, and two uranium-238 results were detected at concentrations exceeding BUTLs. These results also indicated that the samples that detected plutonium-239/240 and uranium-238 exceeding BUTLs were at concentrations below the maximum background concentrations. The results of the samples that detected americium-241 exceeding maximum background concentrations were from soil samples collected from boreholes 55193 and 55293 from depths of 0 to 8 and 0 to 6 ft, respectively. Therefore, it appears that only americium-241 contamination is present in concentrations greater than maximum background concentrations and is not present below the depth of approximately 8 ft.

IHSS 133.6. IHSS 133.6 encompasses the Concrete Wash Pad area that was active during the 1950s. The general configuration of the site was derived from vertical aerial photographs (Figure 2.5.3.2-1). The concrete appeared to be the thickest along the north side where presumably, the trucks dumped their concrete loads and were washed out.

Three deep boreholes, 54893, 54993, and 55093 were drilled downslope of the area designated as IHSS 133.6 (Figure 2.5.3.2-3) to depths of 15, 14, and 14.5 ft, respectively (Table 2.5.3.2-1 and Figure 2.5.3.2-13). Claystone bedrock was encountered at depths ranging from 8.2 to 9.3 ft. No suspected ash material was encountered in the three boreholes. One borehole (55093) encountered groundwater at a depth of 5 ft (Figure 2.5.3.2-13). A groundwater sample was collected from a depth of 6 to 8 ft via the Hydropunch II® groundwater sampling system.

A soil sample was collected for geotechnical analysis (i.e., particle size analysis) from borehole 55093 from 0 to 2 ft. The results of this analysis are presented in Appendix E, Figure E9. These results indicate the surface material to be well graded. Based on the grain size analysis, 6.1 percent of the sample was gravel (i.e., retained on the #4 sieve), 50.8 percent of the sample was sand (i.e., passed through the #4 sieve but retained on the #200 sieve), and 43.1 percent of the sample was silt/clay (i.e., passed through the #200 sieve). This sample has been classified as a SM/SC, using the USCS.

During the drilling of these boreholes, field monitoring, as described in Section 2.5.3.2.2, was conducted on the core. All of the monitoring results from the OVM, the alpha and beta/gamma probes, and radiation smears were below background levels.

Analytical results of the constituents detected at concentrations exceeding BUTLs from the soil samples collected from boreholes 54893, 54993, and 55093 are presented on Table 2.5.3.2-3. IHSS.

Metals. As presented on Table 2.5.3.2-3 and Figure 2.5.3.2-7, the metals analyses detected only barium at a concentration exceeding BUTLs. This constituent was detected only at borehole 54993 and at a concentration below the maximum background concentrations. Therefore, it appears that metals contamination is not a concern at this IHSS.

Radionuclides. As presented on Table 2.5.3.2-3 and Figure 2.5.3.2-8, the radiological analyses detected only plutonium-239/240 at concentrations exceeding the BUTL. This constituent was detected at boreholes 54893 and 55093 at concentrations below the maximum background concentrations. Therefore, it appears that radionuclide contamination is not a concern at this IHSS.

Table 2.5.3.2-2 includes the analytical results of the groundwater sample collected from borehole 55093. As shown in this table, the results of laboratory analysis of groundwater samples did not detect any radionuclides with concentrations exceeding BUTLs. The results, however, do indicate the presence of metals.

The metals constituents that were detected at concentrations exceeding the BUTLs include aluminum, barium, chromium, iron, lead, nickel, potassium, and vanadium. All of these constituents were detected at concentrations that exceed the maximum background concentrations with the exception of lead, nickel, and vanadium. In addition, nickel was also detected in the lab blank that was run with this sample.

Pit and Disturbed Area. A previously undocumented pit and disturbed area was identified during the aerial photograph review (Figure 2.5.3.2-1). Two deep boreholes, 57493 and 57593 were drilled in this area. These boreholes were drilled to depths of 30.4 and 18 ft and encountered claystone bedrock at depths of 18.6 and 11.7 ft, respectively (Table 2.5.3.2-1 and Figure 2.5.3.2-5). No suspected ash material was encountered in either of these two boreholes.

Groundwater was encountered in borehole 57493 at approximately a depth of 16 ft. However, there was not enough water present to collect a sample.

One soil sample was collected for geotechnical analysis (i.e., particle size analysis) from borehole 57493 at 0 to 2 ft. The results of this analysis, are presented in Appendix E, Figure E19. These results indicate this sample to be well graded and classified as a GM/GC using the USCS. This analysis revealed that 27.9 percent of the sample was gravel (i.e., retained on the #4 sieve), 23.7 percent of the sample was sand (i.e., passed through the #4 sieve but retained on the #200 sieve), and 48.4 percent of the sample was silt/clay (i.e., passed through the #200 sieve).

During the drilling of these boreholes, field monitoring, as described in Section 2.5.3.2.2, was conducted on the core. All of the monitoring results from the OVM, the alpha and beta/gamma probes, and radiation smears were below background levels.

Analytical results of the constituents detected at concentrations exceeding BUTLs from the soil samples collected from boreholes 57493 and 57593 are included in the summary on Table 2.5.3.2-3.

Metals. No metals constituents were detected at concentrations exceeding BUTLs at this location. Therefore, it appears that metals contamination is not a concern at this site.

Radionuclides. As presented on Figure 2.5.3.2-8, the radiological analyses detected only gross beta and uranium-235 exceeding BUTLs. A total of one gross beta (57493) and two uranium-235 (57493 and 57593) results were detected at concentrations exceeding BUTLs. Both of these constituents were detected at concentrations below the maximum background concentrations. Therefore, it appears that radionuclide contamination is not a concern at this location.

HPGe Anomaly. A previously undocumented waste disposal area was identified by the initial HPGe survey. One deep borehole, 58093, and one shallow offset borehole, 58093A, were drilled within this anomaly. The shallow offset boring was drilled to 5 ft, where radioactivity was detected on the down-hole drilling equipment (400 cpm field reading), indicating the presence of waste. Therefore, this boring was abandoned and the rig was offset to drill the deep boring. Boring 58093 encountered waste material, described on the field log as ash, broken glass, and metallic debris, at approximately 4.5 to 10 ft. Groundwater was encountered at approximately 7 ft, and claystone bedrock was encountered at 10 ft (Table 2.5.3.2-1).

During the drilling of this borehole, field monitoring, as described in Section 2.5.3.2.2, was conducted on the core. Beta/gamma activity was detected in the field at 1,500 and 1,000 cpm at 2 to 4 and 6 to 8 ft, respectively. The results of the radiation smear counts from these samples, however, were not greater than background levels. The rest of the monitoring results from the OVM, the alpha and beta/gamma probes, and the sample radiation smears were all below background levels.

A groundwater sample was collected at borehole 58093 at 8 to 10 ft. This sample was analyzed for TAL metals, total uranium, plutonium, americium, gross alpha, and gross beta, only. Table 2.5.3.2-2 presents the analytical results of the groundwater sample collected. As shown on this table, the radionuclides detected at concentrations exceeding BUTLs included plutonium-239/240, uranium-233/234, uranium-235, uranium-238, gross alpha, and gross beta. These constituents were all detected at concentrations that exceed the maximum background concentrations.

There were five metals, copper, iron, potassium, silver, and zinc, detected at concentrations exceeding the BUTLs (Table 2.5.3.2-2). Copper and silver are the only metals that were detected at concentrations that exceed the maximum background concentrations. Copper was detected at a concentration of 311 μg/L, and silver was detected at a concentration of 28.2 μg/L. Iron, potassium, and zinc were all detected at concentrations below the maximum background concentrations at 16,900, 5,560, and 326 μg/L, respectively.

Analytical results of the constituents detected at concentrations exceeding BUTLs from the soil samples collected from borehole 58093 are presented on Table 2.5.3.2-3.

Metals. As presented on Table 2.5.3.2-3 and Figure 2.5.3.2-7, the metals analyses detected antimony, cadmium, chromium, copper, nickel, silver, and zinc at concentrations exceeding BUTLs. These constituents were all detected in the sample collected from a depth of 0 to 8 ft. All of these constituents, except for nickel, were detected at concentrations exceeding the maximum background concentration. Based on these results, it appears that the investigation was successful in finding an unknown location of waste disposal. However, it appears that all of the metals contamination detected exceeding maximum background concentrations is not present below the depth of approximately 8 ft.

Radionuclides. As presented on Table 2.5.3.2-3 and Figure 2.5.3.2-8, the radiological analyses detected americium-241, gross alpha, gross beta, plutonium-239/240, and total uranium at concentrations exceeding BUTLs and background concentrations. Each of these constituents were detected in concentrations exceeding the maximum background concentrations in the sample collected from depths of 0 to 8 ft. The sample collected at a depth of 10 to 11.7 ft detected only uranium-235 and uranium-238 at concentrations exceeding BUTLs. However, the uranium-235 detected at this depth was below the maximum background concentration where the uranium-238 was at a concentration exceeding the maximum background concentration. Based on these results, it appears that the investigation found an unknown location of waste disposal. However, it appears that the radionuclide contamination is not present below of approximately 11.7 ft.

2.5.3.3 Investigation of Magnetic Anomaly

The investigation of an anomaly identified by the magnetic survey of the IHSS 133 area (see Section 2.5.2.2-1) was also conducted as part of Stage 3 activities and is described in this section. The performance of this investigation was not specified in the OU5 Work Plan.

2.5.3.3.1 Introduction

Results from the magnetic survey conducted in Stage 2 of the Phase I Investigation discussed in Section 2.5.2.2 indicated an anomaly on the west side of the IHSS 133 area (Figure 2.5.3.3-1). Since the dimensions of this anomaly were similar to the Ash Pits, it was necessary to investigate this anomaly in the event that an unknown ash pit was at this location. This anomaly was investigated by drilling three soil borings along the long axis of the anomaly (Figure 2.5.3.3-1) in accordance with a letter dated July 19, 1993 (Appendix A).

2.5.3.3.2 Drilling and Sampling Procedures

Three soil borings (64493, 64593, and 64693) were installed by advancing a hydraulically-driven Kansas Sampler in accordance with SOP GT.02, DCN 93.03. With this technique, samples were collected inside a clear polyethylene tube lining the Kansas sampler core barrel. Once the core barrel was removed from the borehole and the soil was extracted from the liner, it was scanned with an alpha and a beta/gamma probe to detect radioactivity, and an OVM to detect VOCs. The recovered soil was then measured and visually logged and classified.

Soil samples were collected from ground surface to a depth of refusal. Six-foot composite samples were collected from these soil borings and analyzed for TAL metals, total uranium, plutonium, americium, gross alpha, and gross beta. In order to obtain these composite samples, the recovered core was placed in a safe location, out of direct sunlight, until three consecutive 24-inch samples were obtained. Once the three consecutive samples were obtained, the soil was mixed into a 6-foot composite, and placed in appropriate containers for laboratory analysis, according to SOP FO.13.

In addition to the 6-foot composite samples, 2-foot composite samples were collected from the top 2 ft to assist in the ecological assessment study. These samples were analyzed for the same constituents as listed in the previous paragraph.

2.5.3.3.3 Results

Boreholes 64493, 64593, and 64693 were drilled to 14, 20, and 16 ft, respectively. Total depths were based on equipment refusal, thus bedrock was not encountered in any of these borings. Refusal was experienced prior to reaching bedrock in all three boreholes. No ash, waste material, or groundwater were encountered in these boreholes. The alluvial material encountered appeared to be undisturbed Rocky Flats Alluvium.

During the drilling of these boreholes, field monitoring, as described in Section 2.5.3.3.2, was conducted on the core. The monitoring results from the OVM, the alpha and beta/gamma probes, and radiation smears were all below background levels.

Soil samples were collected, as described above, and sent for laboratory analyses. The available analytical results for this TM were obtained from the EG&G's RFEDS. The analytical results for the soil samples collected from boreholes 64493, 64593, and 64693 included only radionuclide constituents and TAL metals. VOCs and SVOCs were not tested because the waste suspected of being disposed of in this area had been incinerated prior to disposal. Therefore, any VOCs or SVOCs would have been destroyed during incineration.

Analytical results of the constituents detected at concentrations exceeding BUTLs from the soil samples collected from boreholes 64493 through 64693 are summarized on Table 2.5.3.3-1.

Metals. As presented on Table 2.5.3.3-1, the metals analyses detected one barium result and one nickel result exceeding BUTLs and at concentrations below the maximum background concentrations. The barium was detected in a soil sample collected from borehole 64693 at depth of 0 to 6 ft. The nickel was detected in a soil sample collected from borehole 64493 at a depth of 12 to 14 ft.

Radionuclides. As presented on Table 2.5.3.3-1, the radionuclide analyses detected two plutonium-239/240 results at concentrations exceeding BUTLs. These results were from soil samples collected from boreholes 64493 and 64693. The sample collected from borehole 64493 was detected at a concentration below the maximum background concentration. The sample collected from borehole 64693 was detected at a concentration of 0.076 pCi/g.

2.5.4 Stage 4

Stage 4 activities at the IHSS 133 sites consisted of the installation and sampling of groundwater monitoring wells and aquifer testing. The implementation and results of these activities are discussed in this section.

2.5.4.1 Groundwater Investigation

The OU5 Work Plan specified that monitoring wells be installed and sampled at the IHSS 133 sites. The Work Plan further stipulated that the details of the groundwater monitoring program be outlined in a TM to be approved by EPA and CDH prior to implementation.

2.5.4.1.1 Introduction

According to the OU5 Work Plan (DOE, 1992a), three monitoring wells were to be installed in IHSS 133 as part of the OU5 Phase I RFI/RI. The OU5 Work Plan stipulated that the exact location, type, and number of monitoring wells would depend on the results of the preliminary Phase I investigations and that this information would be presented to the agencies in a TM. TM9 was prepared and issued to the agencies on June 18, 1993 (EG&G, 1993g). This TM proposed four wells to be installed downgradient of IHSS 133 (Figure 2.5.4.1-1). The purpose of these wells was to monitor future and present contaminant levels downgradient of IHSS 133 and to help establish future or present contaminant migration problems.

The proposed monitoring well locations presented in TM9 were selected based on the results of the aerial photograph review, the HPGe survey, the geophysical surveys, the soil boring program, the well point water-level data, and field reconnaissance. Three cross sections were developed from field logs of previously installed soil borings to assess potential groundwater flow paths. Flow paths of particular interest were those originating from, or going through, areas that were known to have contained ash or waste material because of their increased likelihood of transporting contamination.

One monitoring well location, 58793, proposed on the east end of the IHSS 133 area (designated as "A" on Figure 2.5.4.1-1), was selected based on a number of factors. First, two of the six boreholes drilled within the area designated as IHSS 133.2 as a part of the Stage 3 soil boring program encountered ash and three encountered groundwater. Second, it was thought that an alluvial channel may be incised in bedrock beneath IHSS 133.2. A well located in this possible channel would presumably characterize groundwater percolating through contamination associated with IHSS 133.2. Finally, groundwater percolating through the disturbed area located to the northeast of IHSS 133.2 might also be characterized with a well at this location, because bedrock appeared to slope from the disturbed area toward the channel.

The proposed location for the monitoring well 63093 positioned to the south of the HPGe anomaly (designated as "C" on Figure 2.5.4.1-1), was located in an attempt to characterize groundwater that may have percolated through this HPGe anomaly (borehole 58093 was drilled directly in the center of this anomaly). A bedrock low beneath borehole 58093 was assumed to be a potential flow path for the contaminants associated with this boring. It was also assumed that bedrock slopes to the south, directing groundwater within this channel toward the proposed well location.

One monitoring well was to be positioned to the southwest of borehole 56393 (designated as "B" on Figure 2.5.4.1-1) in an attempt to characterize groundwater that may have percolated through the waste associated with the contamination detected in borehole 56393. The direction of flow of groundwater affected by contaminants detected in borehole 56393 was thought to be to the southwest. This assumption was based on an interpretation of bedrock surface topography and the lithology of the alluvium within the IHSS 133.1/133.3 area. Field borehole lithologic logs from boreholes 56393, 56493, 56793, and 56693 indicate that the alluvial materials are predominantly clay. The alluvial material in borehole 56593 is clayey to silty sands and clayey to sandy gravels from a depth of 4 ft to bedrock. This information, together with borehole 56593's depth to bedrock, appeared to indicate a preferential groundwater flow path to the southwest, though groundwater was not found at this location.

The proposed location for the westernmost well (designated as "D" on Figure 2.5.4.1-1) was chosen in an effort to characterize groundwater travelling to the southwest from the IHSS 133.4 boreholes, west of borehole 55893. It was presumed in TM9, that groundwater would flow to the south and west from these borehole locations. This was based on the probable slope of bedrock, and the flow of Woman Creek to the east. No geologic control (borehole logs) existed to verify this assumption.

Upon completion of well installation activities, one area within IHSS 133 was selected for field characterization of aquifer parameters. Characterization of aquifer parameters was necessary to provide information for hydrogeologic groundwater flow models to be developed as directed in the OU5 Work Plan.

One-time groundwater sampling was conducted on two well points, 62593 and 62693, installed in seeps near IHSS 133 (Figure 2.5.4.1-2). These well points were installed as part of an investigation of seeps and springs.

2.5.4.1.2 Field Procedures

Hollow-stem augers were used for advancing the three boreholes in which wells 58793, 59093, and 63093 were installed in accordance with SOP GT.02 (Figure 2.5.4.1-2). The borings were drilled 4 to 5 ft into weathered bedrock in accordance with the OU5 Work Plan (DOE, 1992a). During the drilling of the boreholes, soil samples were collected for chemical and geologic analyses. Samples were collected by driving a split-spoon sampler with a 140-pound slide-hammer. Once the sampler was removed from the borehole and opened, its contents were scanned with an alpha and a beta/gamma probe to detect radioactivity, and an OVM to detect VOCs. The recovered core was then measured, examined visually for the presence of waste material, and the lithology was classified and logged.

Soil samples were collected from ground surface to the first bedrock interval. Six-foot composite samples were collected and analyzed for TAL metals, total uranium, plutonium, americium, gross alpha, and gross beta, as specified in the OU5 Work Plan (DOE, 1992a) and TM9 (EG&G, 1993g). In order to obtain these composite samples, the samples were placed in a safe location, out of direct sunlight, until three consecutive 24-inch, or four consecutive 18-inch samples totaling the required 6 ft, were collected. The soil was then mixed into a 6-foot composite and placed in appropriate containers for laboratory analysis.

In addition to the 6-foot composite samples, 2-foot composite samples were collected from the top 2 ft of the boreholes to assist in the ecological assessment study. These samples were analyzed for the same constituents as the 6-foot composite samples discussed above.

Following the completion of a boring, 2-inch inside diameter PVC wells were installed in accordance with SOP GT.06. These wells were constructed inside the 6-1/4-inch inside diameter hollow-stem augers. The bottom of the 10-foot screened interval was located at or near the bedrock/alluvium contact for wells 58793 and 59093 (Figure 2.5.4.1-3). The bottom of the 10-foot screened interval in well 63093 was located 2.4 ft below the top of bedrock, because sandstone was encountered at the bedrock contact. Silica sand was installed within the annulus between the boreholes and the well casings from just below the bottom of the screened intervals to a range of 0.6 to 2.6 ft above the top of the screened intervals. Bentonite seals were installed above the filter packs at thicknesses ranging from 2.8 to 3.9 ft. Each well was then completed by filling the remaining annulus with concrete; installing a steel, locking, protective casing; and constructing a 3- by 3-foot concrete pad around the protective casing.

All of the wells installed in IHSS 133 are being sampled on a quarterly basis. The first round of quarterly sampling was conducted during June 1993. If enough groundwater is present at the time of sampling, groundwater samples are analyzed for unfiltered total chromium, beryllium, gross alpha, gross beta, uranium-233/234, uranium-235, uranium-238, plutonium-239/240, americium-241, TAL metals, TCL VOCs, TCL SVOCs; and filtered total uranium, plutonium-239/240, cesium-137, strontium-89/90, americium-241, anions, and TDS.

Based on development and sampling histories, only well 58793, located downgradient of this area, appeared to be productive enough to warrant aquifer testing (Figure 2.5.4.1-4). The geologic log of well 58793 indicated the presence of permeable and porous material, predominantly sand, gravel, and clay. Well 58793 is located downgradient of the Ash Pits identified as IHSS 133.2. Three 0.5-inch diameter well points 63593, 63693, and 63793 were installed as observation wells at approximately 3, 6, and 9 ft from pumping well 58793 (Figures 2.5.4.1-4 and 2.5.4.1-5). The installation of these well points is discussed in Section 2.4.4.2.2. The observation wells were developed using a "rawhiding" method as discussed in Section 2.4.4.3.2 and the pumping well was developed in accordance with SOP GW.02. A transducer was installed in pumping well 58793 to electronically record water levels. In addition, water-level readings were taken by hand in the pumping well with a standard water-level indicator to compare to the electronically-recorded water levels. Water levels were taken by hand in the three observation wells with two 3/8-inch diameter Slope Indicator meters and one manometer.

Construction of well points 62593 and 62693 was similar to the well points installed at IHSS 115 and discussed in Section 2.4.4.2. Both were sampled1307XO6s. Well point 62693 was sampled for the entire suite of analyses as listed on Table 2.4.4.2-1. A similar sampling procedure was used as presented in Section 2.4.4.2.

2.5.4.1.3 Results

Nine locations were drilled in the IHSS 133 series area in the attempt to install the four proposed monitoring wells. Groundwater was encountered in only three of the nine locations (58793, 59093, and 63093) (Figure 2.5.4.1-2). The well locations that did not encounter groundwater were plugged, abandoned and reclassified as boreholes (58893, 58993, 59693, 61193, 61393, and 61493). Wells 59093 and 58793 were located as originally proposed in TM9 (Figure 2.5.4.1-2). The third well was finally installed after several attempts. In the first attempt, borehole 58893, waste was encountered in the interval from a depth of approximately 5.6 to 6 ft. This waste was described as white fibrous material mixed with ash and a burnt wood fragment. This boring was abandoned and five other attempts to find groundwater were made before well 63093 was installed.

The recovered core was visually logged as the boreholes were advanced, according to SOP GT.01. It was later more carefully examined and classified utilizing sieves and other equipment at a designated logging facility, as required in SOP GT.01. The results of this effort indicated that the bedrock encountered at wells 58793 and 59093 was claystone. The top 2.5 ft of bedrock encountered at well 63093 was sandstone, grading to sandy claystone below this depth (Figure 2.5.4.1-2). The alluvial material encountered in boreholes 58793, 59093, and 63093 was 24.6, 14.3, and 19.6 ft thick, respectively.

Groundwater was encountered during drilling at approximately 11.4 ft at borehole 58793 (Figure 2.5.4.1-2). At boreholes 59093 and 63093, the soils were described as having only some moisture. Water levels were taken in the three wells during August 1993. Well 58793 had the greatest saturated interval of 11.12 ft, well 59093 had a saturated interval of 2.17 ft, and well 63093 had a saturated interval of 0.98 foot (Figure 2.5.4.1-2).

During the drilling of these boreholes, field monitoring, as described in Section 2.5.4.1.2, was conducted on the core. The monitoring results from the OVM, the alpha and beta/gamma probes, and radiation smears were all below background levels.

Monitoring Well Borehole Soil Samples. The analytical results from the soil samples collected from the IHSS 133 monitoring well boreholes available as of January 28, 1994 include TAL metals and radionuclides. Because the IHSS 133 series area contains primarily incinerator residue and ash material, no analyses to detect organic compounds were performed on the soil samples taken in the IHSS 133 series area. Table 2.5.4.1-1 summarizes the results for TAL metals and radionuclides detected at concentrations exceeding BUTLs.

Metals. The TAL metals analyses resulted in three constituents, antimony, barium, and zinc, exceeding BUTLs. Two samples from wells 58893 and 61493 at a depths of 0 to 2 and 6 to 12 ft, respectively, had barium concentrations of 374 and 369 mg/kg, respectively, exceeding the BUTL. One sample from well 58993 at a depth of 0 to 6 ft had an antimony concentration of

52 mg/kg which exceeds the BUTL. One sample from well 61193 at a depth of 6 to 10 ft had a zinc concentration of 298 mg/kg which exceeds the BUTL.

Radionuclides. Plutonium-239/240 was detected at concentrations exceeding the BUTL in three soil samples taken from the IHSS 133 monitoring well boreholes. It was detected in a soil sample collected from well 58993 at a depth of 6.4 to 10 ft, one from well 59093 at a depth of 0 to 6 ft, and one from well 61193 at a depth of 6 to 10 ft. The concentrations detected were 0.042, 0.037, and 0.068 pCi/g, respectively.

Monitoring Well Groundwater Samples. The analytical results from the groundwater samples collected from the monitoring wells in IHSS 133 during the quarterly sampling events available as of January 28, 1994 include TAL metals, radionuclides, pesticides, PCBs, and water quality parameters. Because the IHSS 133 series area contains primarily incinerator residue and ash material, no analyses to detect SVOCs or VOCs were performed on the samples taken in the IHSS 133 series area. Table 2.5.4.1-2 summarizes the analytical results for TAL metals and radionuclides that exceeded BUTLs.

Metals. Of the monitoring wells being sampled, TAL metal analyses revealed only one well, 58793, in IHSS 133 with metals concentrations in the groundwater exceeding BUTLs. Analyses of a sample taken on June 18, 1993 resulted in 18 constituent concentrations that were greater than BUTLs (Table 2.5.4.1-3). Of these, 16 also exceeded the maximum background concentration for these constituents. Analyses of a sample taken on August 12, 1993 resulted in 12 constituent concentrations exceeding BUTLs with eight of these also greater than maximum background concentrations. Analyses of filtered portions of these same two samples resulted in only manganese concentrations exceeding both the BUTL and the maximum background concentrations.

Radionuclides. Radionuclide analyses of groundwater samples revealed only one well, 58793, with radionuclide concentrations exceeding the BUTLs. Analyses of a sample taken on June 18, 1993 resulted in total radium-226 (1.4 pCi/L) and total americium-241 (0.058 pCi/L) concentrations exceeding BUTLs. Analysis of a sample taken on August 12, 1993 also resulted in a total radium-226 (3.9 pCi/L) concentration exceeding the BUTL.

Pesticides and Polychlorinated Biphenyls (PCBs). No pesticides or PCBs were detected in IHSS 133 monitoring well groundwater sample analyses available to date.

Water Quality Parameters. Water quality analyses identified parameters exceeding BUTLs only in well 58793. The sample taken on June 18, 1993 contained total suspended solids and chloride concentrations (12,000 and 64 mg/L, respectively) exceeding BUTLs. The sample taken on August 12, 1993 contained the same two parameters (8,000 and 54 mg/L, respectively) in concentrations exceeding their respective BUTLs.

Appendix B includes the results of chemical analyses of samples collected from well points 62593 and 62693. None of the organic constituents that were analyzed for were detected. None of the general water quality parameters, metals, or radionuclides were detected exceeding BUTLs.

Aquifer Test Results. Attempts at performing a continuous pumping rate aquifer test on well 58793 were unsuccessful. Information gathered from sampling paperwork on this well indicated it recovered rapidly and did not dewater during purging and sampling. No drawdown to insignificant drawdown was recorded in the observation wells during testing, and measurements of drawdown in the pumping well were not analyzable. The drawdown curve in the pumping well probably consists of wellbore storage and storage in the 10- to 12-inch filter pack, with minimal contribution from the formation. Geologic logs of pumping well 58793 indicate that a sand and gravel unit exists from 12 to 14 ft below the surface. During development and sampling earlier in the year, the static water level was above this unit. When aquifer testing was attempted in late summer, the static water level drew down to the base of this unit. It seems likely that this unit is the productive unit and that the remaining 10 ft of sandy clay and clayey sand beneath this unit are relatively impermeable.

2.5.5 Ambient Air Monitoring

Ambient air monitoring activities associated with the site characterization of IHSS 133 were similar to those conducted for the investigation of IHSS 115. These activities are discussed in Section 2.4.6.1

2.5.5.1 Introduction

The RAAMP network and the special samplers for OU5 are discussed in Section 2.4.6.1. Sampler S102 is positioned as an upwind sampler for OU5. S101 is situated at a downwind location from IHSS 133.

H&S monitoring for organic gases and radiation as described in Section 2.4.6.1 were also implemented for IHSS 133. Personal air sampling for ACM was also conducted during those drilling operations when suspect material was encountered in IHSS 133.

2.5.5.2 Procedures

The operation of the ambient samplers of the RAAMP network is discussed in Section 2.4.6.2. H&S monitoring for organic gases and radiation was conducted at IHSS 133 in the same manner as the monitoring performed for IHSS 115. See Section 2.4.6.2 for the discussion of the H&S monitoring procedures.

When ACM were encountered during field investigation of IHSS 133, the H&S technician wore an Alpha1 personal air sampler. The sampler pump was calibrated according to manufacturer's instructions at the beginning of each work day. The personal air sampler was operated at all times when ground disturbance activities were conducted. Air sampler filters were analyzed by a commercial analytical laboratory.

2.5.5.3 Results

Results of the RAAMP samplers are discussed in Section 2.4.6.3. The sampling results of the special OU5 sampler (S-101) situated downwind of IHSS 133 are similar to those for the IHSS 115 downwind sampler (S-100). Examination of the special OU5 sampler data indicates that the uranium-233/234 and uranium-235 results are within the same order of magnitude for both the S-101 sampler downwind of IHSS 133 and the S-102 sampler upwind of OU5. These preliminary data seem to indicate no discernible contributions to ambient concentrations of either uranium-233/234 or uranium-235 from IHSS 133. This same analysis appears to apply also to plutonium-239/240 in the case of IHSS 133. The americium-241 and uranium-238 average concentrations for the downwind S-101 sampler are one order of magnitude greater than the average concentrations of the upwind S-102 sampler. Contributions to ambient concentrations of americium-241 or uranium-238 by IHSS 115 appear possible. In all cases, for all data, conclusions about possible radionuclide emissions from IHSS 133 can be made only after complete statistical analysis of validated data.

No elevated organic vapor levels were observed during field investigations of IHSS133. Elevated beta-gamma readings greater than a background of less than 250 cpm were encountered during soil boring activities at locations 55993 (2,500 cpm), 56893 (1,000 cpm), 55993 (850 cpm), 56393 (7,500 cpm), and 58093 (600 cpm).

Levels of ACM were reported from the personal air sampler filters worn by H&S staff during work at locations 57393, 56593, 56793, 57593, 55893, 56393, 57293, and 58093 in IHSS 133. The maximum sample result was 0.031 fibers per cubic centimeter. None of the results exceeded the American Conference of Governmental Industrial Hygienists (ACGIH) 8-hour Time Weighted Average occupational exposure limit of 2 fibers per cubic centimeter (Appendix B.7-3). The results indicate that there is some potential for release of ACM during ground disturbance activities in IHSS 133, such as additional field investigations or remediation.

2.6 IHSS 142.10 AND IHSS 142.11 (C PONDS)

The following sections discuss the field activities conducted at Ponds C-1 and C-2 and the results obtained from these activities.

2.6.1 Stage 1 - Review of Existing Data

The OU5 Work Plan specified that existing data regarding surface-water and sediment quality in Ponds C-1 and C-2 be evaluated. This evaluation was to determine the adequacy of the existing data in meeting the needs of the OU5 RFI/RI and if additional sampling was required to meet the RFI/RI objectives.

2.6.1.1 Surface-Water and Stream Sediments

Initial water-quality and bottom-sediment chemistry characterization of selected surface-water sites in the Woman Creek drainage basin were reported by Rockwell International (1986) as part of the RFP RCRA Part-B permit application. Beginning in 1990, a sitewide monitoring program was implemented, which included a series of SW and SED monitoring sites within the Woman Creek drainage basin (EG&G, 1991b and 1992f). Several of these sites provided data useful for a preliminary site characterization of the OU5 area (DOE, 1992a, Section 2.0 and Appendices D and E; EG&G, 1994a).

The most recent overview of the sitewide surface-water and sediment monitoring plan is that provided by EG&G (1992g). Relevant data for this program for the Woman Creek drainage are noted in the following sections. However, reductions and modifications in this sitewide monitoring program have taken place over time (see, for example, EG&G, 1991b, 1991c, 1992g). In essence, monitoring-program reductions can be summarized as follows, relative to the sitewide program:

- Prior to October 1991, a sitewide network was in operation involving 108 SW sites and 38 SED sites (EG&G, 1991b). Samples were collected monthly; however, analyses of organic constituents (priority pollutants) and sampling of bottom sediments were to be completed on a quarterly schedule.

- Between October 1991 and March 1992, the number of monitoring sites in the sitewide network was reduced to 82 SW sites and 24 SED sites (EG&G, 1992g). A quarterly sampling and analysis frequency was given for both categories of sites.

- Beginning April 1992, the RFP-sitewide network was reduced further, and 32 SW sites (30 existing and 2 new) and 33 SED (19 existing and 14 new) sites were associated with OU5 monitoring (EG&G, 1991c and 1992f, Table 5). However, several OU5-related additional (new) surface-water and sediment monitoring sites were implemented at the time of executing the FSP for the RFI/RI (EG&G, 1993a, as amended).

2.6.1.2 Pond Water Quality

In developing the technical rationale for FSP changes, use was made of a number of data sources and data types. Certain available data were summarized in the OU5 Work Plan (DOE, 1992a, Appendices C, D, and E). It would appear that the primary data source for the OU5 Work Plan was RFEDS. However, other supplementary data sources were sought out and obtained during the investigative part of this compilation; relevant aspects of this data-summary evaluation have been considered in the final TM1 report (EG&G, 1993a, amended) and the Hydrologic Data Summary (EG&G, 1994a).

Water-quality characterization of the C-series pond is of primary concern to the OU5 Work Plan. The composition and regulatory drivers of various ongoing water-quality monitoring programs of the C-series pond are summarized in EG&G (1994a, Table 1). These drivers include the Agreement in Principal (DOE and CDH, 1989), DOE Order 5400.1, and the Federal Facility Compliance Agreement (FFCA) (EPA, 1991). Historical C-series pond data are discussed in this section. As is summarized below and based upon associated C-series pond historical data (EG&G, 1994a, Appendices A through E), it was apparent that useful data were available from other sources within continuing EG&G-ER/SWD programs. Therefore, only selected supplemental C-series pond data were collected as part of the OU5-FSP field investigations (EG&G, 1993a, amended; also, see Tables 2.4.3.4-1 through 2.4.3.4-4). These supplemental data focused upon continuing HydroLab profiles in Pond C-1, obtaining C-pond bottom-sediment samples for a one-time survey (see EG&G, 1994a, Section 2.2), and collaborating with the ongoing RFP Surface-Water Toxicity Monitoring Program.

Recent RFP annual environmental reports (EG&G, 1991d, 1992h, 1993k, 1994c for 1989 through 1992, respectively) provide an excellent overview of CWA compliance monitoring, which includes NPDES-related aspects. Operational monitoring program components have been widely varying, relative to sample scheduling and variables analyzed. Historical operational and/or CWA-compliance data are tabulated in EG&G (1994a, Appendices C and D for Pond C-1 and Pond C-2, respectively). Many of these resultant C-pond data have not been included in the computerized RFEDS database and thus are available principally in hardcopy form from EG&G staff who are knowledgeable in the collection of such data for operational purposes. In addition, it should be noted that these data in general have not undergone rigorous quality assurance/quality control review protocols (EG&G, 1990, 1991e, 1991f). Available historical RFEDS data are tabulated in EG&G (1994a, Appendices A and B for Pond C-1 and Pond C-2, respectively).

Biological and limnological data on the C-series ponds are not available. Also, with few exceptions (EG&G, 1994a), basic water-quality and sediment quality data for the C-series ponds generally do no include a full suite of nutrient (nitrogen and phosphorus) species. Therefore, little can be deduced about plankton populations through modelling until biological data are available to compare with modeling results. Biological data for Woman Creek and the C-series ponds, in terms of identification of aquatic species (plankton, periphyton in ponds, fish, and benthic invertebrates) and associated numbers, are expected to be available as part of the Environmental Evaluation of OU5.

In June 1989, an initial biomonitoring survey using the whole-effluent-toxicity (WET) test methodology was conducted in Pond C-2. A second survey was conducted in January 1990. Indicator aquatic species used in this test were fathead minnows and the *Ceriodaphnia dubia*. Beginning in March 1990, monthly biomonitoring surveys (April and November 1991 surveys were not included) have been conducted by EG&G personnel in Pond C-2 and for Pond C-2 discharges (when applicable). These historical biomonitoring results for Pond C-2 (June 1989; January 1990; monthly between March 1990 through March 1991) indicated no toxicity.

Beginning in May 1991, the RFP's Surface Water Toxicity Monitoring Program (SWTMP) was initiated to address the regulatory requirements concerning potential toxicity of effluent discharges for normal and emergency RFP operating conditions (Wolaver and Spence, 1993). This program was developed to provide biological-quality data that meet and exceed applicable regulations and to assist in the interpretation of the extensive data generated as part of the surface-water chemical-quality monitoring program. The SWTMP involves both traditional WET-test surveys (providing an LC_{50}, or lethal concentration 50-percent results) required by EPA, as well as the real-time Microtox method (providing an EC_{50}, or effective concentration 50-percent results). These alternative methods and meanings of the LC_{50} and EC_{50} indicators are described by Wolaver and Spence (1993, pp. 12-13). Routine Microtox tests were conducted for both Pond C-1 and Pond C-2. Monthly split WET tests were made as well only for Pond C-2 (Wolaver and Spence, 1993, Table 1). The Microtox- (EC_{50}) and WET-test (LC_{50}) results have been summarized in EG&G (1994a, Figures 7A and 7B, respectively). Pond C-1 indicated no toxicity during the 13-month study period. Pond C-2 showed Microtoxicity in 3 of 32 samples (9.7 percent occurrence; EG&G, 1994a, Figure 10A). However, it is notable that the water incoming to RFP indicated toxicity of 7 percent of the samples tested using the Microtox system. The frequency of Microtoxicity found in Pond C-2 was not statistically different from that of incoming RFP water. The cause of these Microtoxicity occurrences in Pond C-2 was unknown (Wolaver and Spence, 1993). Chemical data were available, but the forms in which the chemicals exist and their bioavailability are unknown at this time (Baudo, et al., 1990). However, WET-test results for Pond C-2 indicated no toxicity to either organism during the 14-month (May 1991 through June 1992) survey period.

Two additional sources of water-quality data were useful. As part of an RFP plutonium study by investigators from Colorado State University (CSU), several impoundments were studied at RFP (Johnson, et al., 1974). Water samples were taken at Pond C-1 for each of six surveys. Up to 12 sampling sites aerially distributed across this impoundment were included in each survey. One-liter samples were composited from samples collected from the surface, one-half depth, and full depth at a given location (EG&G, 1994a, Appendix Section E). Sample collection and processing procedures are described in Johnson, et al. (1974). As a second miscellaneous data source, approximately 6 months of field data were collected for Pond C-2 during the latter half of 1990. These HydroLab measurements included readings at various depths in Pond C-2 below the impoundment surface (EG&G, 1994a, Appendix Table E-1). For anticipated hydrologic-modeling inputs (EG&G, 1993l), C-series ponds' discharge volumes and associated water-quality characteristics were useful for the Hydrologic Data Summary (EG&G, 1994a, Appendix F).

2.6.1.2.1 Assessment of Pond C-1 Historical Water-Quality Data

An assessment was made of the Pond C-1 historical water-quality data from the sources outlined above. Results of various time-series plots and statistical summaries of the basic data were made for purposes of a critical evaluation of these historical data to determine which water-quality constituents may constitute site contaminants at Pond C-1. The basic data and time series used are presented in EG&G (1993j) and are not reproduced in this document. For purposes of this analysis, the concentrations of water-quality constituents are compared with BUTL concentrations from RFP (EG&G, 1993i). Because no BUTLs are available specifically for pond water at RFP, BUTLs for surface waters at RFP were used to judge if site contaminants existed in Pond C-1.

For a list of historical RFEDS data at Pond C-1, see Table 2.6.1.2-1. The concentrations of each of the listed constituents was compared to the BUTL (if available) to assess which constituents could be judged to be site contaminants. Results of this comparison at Pond C-1 for historical data (data collected both as part of sitewide RFP sampling and pond operational sampling) are summarized on Table 2.6.1.2-2.

In summary, based upon comparison of historical Pond C-1 water-quality concentration data to BUTLs at RFP for both dissolved and total constituent concentrations, americium-241, plutonium-238, aluminum, barium, iron, manganese, nitrite/nitrate, acetone, methylene chloride, bis(2-ethylhexyl)phthalate and diethyl phthalate exceed BUTLs. Further statistical tests will be undertaken to assess, based upon the total database available, if these small number of concentrations actually constitute site contaminants, or if uncertainties in both the actual and background data only make it appear that these concentrations can be concluded to be site contaminants. Some of the uncertainties in the historical data include analysis methods, reporting formats, errors in data reporting, and reporting errors in total versus dissolved concentrations.

2.6.1.2.2 <u>Assessment of Pond C-2 Historical Water-Quality Data</u>

As with Pond C-1, an assessment was made of the Pond C-2 historical water-quality data from the sources outlined in Section 2.6.1.2.1. Results of various time-series plots and statistical summaries of the basic data were made for purposes of a critical evaluation of these historical data to determine which water-quality constituents may potentially constitute site contaminants at Pond C-2. The basic data and time series used are presented in EG&G (1994a) and are not reproduced in this document.

For a list of historical RFEDS data at Pond C-2 see Table 2.6.1.2-1. Results of a comparison of results at Pond C-2 for historical data (data collected both as part of sitewide RFP sampling and pond operational sampling) to BUTLs indicated that many water-quality constituents had concentrations higher than the BUTL. A summary of these constituents are presented in Table 2.6.1.2-3. In addition to the field and miscellaneous measurements, radionuclides, trace metals and major cations, selected VOCs, SVOCs, pesticides, and herbicides were detected at concentrations higher than detection limits in water samples from Pond C-2. These constituents included 1,1,1-TCA, acetone, ametryn, atrazine, bis(2-ethylhexyl)phthalate, carbon tetrachloride, methylene chloride, prometon, prometryn, propazine, simazine, simetryn, terbuthylazine, PCE, toluene, total xylenes, and TCE (EG&G, 1993j, Table 4B).

In summary, based upon comparison of historical Pond C-2 water-quality concentration data to BUTLs at RFP for both dissolved and total constituent concentrations, it is concluded that the constituents in Table 2.6.1.2-1 are potential water contaminants at Pond C-2. Further statistical tests will be undertaken to assess, based upon the total database available, if these concentrations actually constitute site contaminants, or if uncertainties in both the actual and background data only make it appear that these concentrations can be concluded to be site contaminants. Some of the uncertainties in the historical data include analysis methods, reporting formats, errors in data reporting, and reporting errors in total versus dissolved concentrations.

Field water-quality data collected at Pond C2 with the HydroLab portable monitor were analyzed by plotting profiles of pH, specific conductance, dissolved oxygen, and water temperature with depth for various times of the year. These profiles give an indication of the behavior of Pond C-2 relative to internal water-quality characteristics. Historical Pond C-2 profile data are available for various times during 1990 (EG&G, 1993j, Appendix Table E-1), and 1991 and 1992 (EG&G, 1994a, Appendix Table B-1).

Figures 2.6.1.2-1A through D indicate Pond C-2 profiles for pH, specific conductance, dissolved oxygen, and water temperature, respectively, for various times during June, July, August, September, and November for the 1990 calendar year. Values of pH (Figure 2.6.1.2-1A) are generally quite variable, both over time and with depth, during June, July, and August in Pond C-2. This is probably due to algal blooms which tend to add oxygen, deplete carbon dioxide, and increase pH toward more alkaline conditions. Specific conductances (Figure 2.6.1.2-1B) during the 1990 monitoring period were generally constant over time and also with depth. Dissolved oxygen concentrations in Pond C-2 (Figure 2.6.1.2-1C) indicate that higher concentrations were present at the pond surface during June, July, and August than during other months. This is almost certainly due to algal blooms, because the water-temperature profiles (Figure 2.6.1.2-1D) indicate that the measured dissolved-oxygen concentrations are at super-saturation. Large differences in dissolved-oxygen concentrations versus depth in Pond C-2 also indicate that algal blooms may be occurring and that large amounts of oxygen-demanding detritus are using oxygen near the bottom of the pond. September and November profiles indicate that Pond C-2 is well mixed, with constant dissolved-oxygen concentrations with depth. The water-temperature profiles do not indicate any strong thermal stratification in Pond C-2. The largest change in water temperatures for the 1990 data is 3°C which occurred on June 27 and again on July 25 (Figure 2.6.1.2-1D). It is judged that this water-temperature variation is not sufficient to cause thermal stratification in Pond C-2. The specific-conductance data also indicate that no chemical stratification is present. The change in specific conductance from 870 microSiemens per centimeter (μS/cm) for the measurement on July 5, 1990 at a depth of 1.5 ft to 400 μS/cm at 3.5 ft appears to be an isolated case and may be the result of poor measurements.

The Pond C-2 pH, specific-conductance, dissolved-oxygen, and water-temperature profile data for the years 1991 and 1992 are presented on Figure 2.6.1.2-2. The time periods shown (May 1991, November 1991, March 1992, and April 1992) are for months not available during the 1990 season. The 1991 and 1992 data also indicate that, during these months, Pond C-2 is generally completely mixed and without large amounts of biological activity. General conclusions from the 1990 through 1992 Pond C-2 profiles is that relatively constant conditions exist with depth during the months of August or September through May, and that algal blooms may account for non-constant profiles for pH and dissolved oxygen during the months of June, July, and August. It is further concluded that both thermal and chemical stratification of Pond C-2 is very weak to non-existent during all months of the year.

2.6.1.3 Pond Bottom Sediments

The first known field investigation of pond-sediment chemical characterization applicable to this data-summary report was an RFP study conducted by CSU staff on several RFP ponds, including Pond C-1 (Johnson, et al., 1974). Plutonium-239/240 was used as the indicator variable in this study. Water samples also were collected for this study. Laboratory analyses were done for samples collected for 18 surveys for water and 21 surveys for bottom sediments conducted between May 1971 and August 1973. Detailed sediment-core sampling was conducted in April 1974 for Pond C-1. Specific selected results of this study are described in EG&G (1994a, Section 3.1.2). However, it should be noted that these data in general have not undergone rigorous quality assurance/quality control review protocols (EG&G, 1990, 1991e, 1991f).

On May 4-5, 1992, ponds C-1 and C-2 were sampled by EG&G-contractor field personnel for the purpose of further characterizing bottom-sediment chemistry for radionuclide indicators (gross alpha, gross beta), radionuclides (plutonium-239/240, uranium-234/235, uranium-238, and americium-241); percent solids (by dry weight); trace metals; and organic compounds. Bottom sediments were sampled near the outlet works of each pond; the top 6-inches of sediment were sampled using an Eckman-dredge sampler. Data are given in EG&G (1994a, Appendix Tables E-2, E-3, and E-4).

For purposes of historical-data comparison, several other offsite impoundment bottom-sediment chemistry surveys, some involving water bodies affected by the Woman Creek drainage area, are cited in ASI (1991, p. 32). However, results of these studies have not been included in the Hydrologic Data Summary (EG&G, 1994a) but rather were cited in that document by reference.

2.6.1.3.1 <u>Assessment of Pond C-1 Historical Bottom-Sediment Quality Data</u>

The assessment presented in this section involves the one-time bottom-sediment sample survey of Pond C-1, using an Eckman dredge, near the outlet works on May 4-5, 1992. The concentrations of trace metals and major cations, radionuclides, VOCs, and SVOCs were compared to the BUTL (if available) to assess which constituents in the bottom sediments could be judged to be site contaminants.

Results of this comparison at Pond C-1 for the one-time sediment sample indicated that for stream sediments at RFP (EG&G, 1994a):

- aluminum (29,600 mg/kg) was higher than the BUTL (21,387 mg/kg),
- barium (271 mg/kg) was higher than the BUTL (254 mg/kg),

- calcium (18,500 mg/kg) was higher than the BUTL (18,466 mg/kg),
- nickel (30.5 mg/kg) was higher than the BUTL (24.2 mg/kg),
- potassium (4,220 mg/kg) was higher than the BUTL (3,160 mg/kg),
- selenium (2.6 mg/kg) was higher than the BUTL (2.18 mg/kg), and
- sodium (650 mg/kg) was higher than the BUTL (593 mg/kg).

These relatively small exceedances of bottom-sediment BUTLs may not be false positive values, if additional statistical analyses are conducted on the data.

Radionuclide concentrations in Pond C-1 bottom sediments all were lower than the BUTLs for stream sediments at RFP (EG&G, 1994a). Comparison of the plutonium-239/240 concentration (2.2 pCi/g) for the May 4-5, 1992 sample to the sediment BUTL (5.62 pCi/g), and also the sediment data collected in Pond C-1 and analyzed for plutonium in 1971 through 1973 (EG&G, 1994a, Appendix E) indicates that one sample at Pond C-1 is probably not enough to satisfactorily characterize the system. The 1971-1973 sediment-concentration data for plutonium ranged from 0.18 pCi/g to over 100 pCi/g. Average Pond C-1 bottom-sediment plutonium concentrations for the 1971-1973 sampling period ranged from approximately 1.0 pCi/g to over 10 pCi/g. Of the 21 average bottom-sediment plutonium values for the 1971-1973 period, only one was higher than the currently applicable stream-sediment BUTL (EG&G, 1994a).

The only SVOC in the Pond C-1 sediment sample which had a concentration higher than the instrument detection limit was bis(2-ethylhexyl)phthalate. An additional 20 unknown compounds or TICs were also detected in concentrations less than detection limits.

Based upon the one-time historical sediment sample obtained from Pond C-1 on May 4, 1992, it is concluded that site contaminants for this pond should be determined by examining the more recent (November 1993) sediment data presented below. Final determination of the site contaminants in the Pond C-1 bottom sediments should be a combination of both historical and recent data. However, plutonium may be a site contaminant in Pond C-1 bottom sediments, based upon the historical data.

2.6.1.3.2 <u>Assessment of Pond C-2 Historical Bottom-Sediment Quality Data</u>

Results of comparison of trace-metal and major-ion concentrations at Pond C-2 for the one-time (May 4-5, 1992) sediment sample indicated that for stream sediments at RFP (EG&G, 1994a):

- aluminum (33,500 mg/kg) was higher than the BUTL (21,387 mg/kg),
- arsenic (13.9 mg/kg) was higher than the BUTL (10.1 mg/kg),
- barium (261 mg/kg) was higher than the BUTL (254 mg/kg),
- calcium (51,100 mg/kg) was higher than the BUTL (18,466 mg/kg),
- chromium (34.5 mg/kg) was higher than the BUTL (31.8 mg/kg),
- iron (27,900 mg/kg) was higher than the BUTL (26,600 mg/kg),
- magnesium (6,460 mg/kg) was higher than the BUTL (5,360 mg/kg),
- nickel (25.9 mg/kg) was higher than the BUTL (24.2 mg/kg),
- potassium (4,930 mg/kg) was higher than the BUTL (3,160 mg/kg),
- sodium (616 mg/kg) was higher than the BUTL (593 mg/kg),
- vanadium (74.9 mg/kg) was higher than the BUTL (63.4 mg/kg), and
- zinc (236 mg/kg) was higher than the BUTL (139 mg/kg).

Some of these excursions from BUTL may be within reasonable limits, if additional statistical analyses are conducted on the data.

Radionuclide concentrations in Pond C-2 bottom sediments all were lower than the BUTLs for stream sediments at RFP (EG&G, 1994a). The only SVOC in the Pond C-2 sediment sample which had a concentration higher than the instrument detection limit was bis(2-ethylhexyl)phthalate. An additional 19 unknown compounds or TICs were also detected at concentrations less than detection limits.

Based upon the one-time historical sediment sample obtained from Pond C-1 on May 4, 1992, it is concluded that site contaminants for this pond should be determined by examining the more recent (November 1993) sediment data presented below. Final determination of the site contaminants in the Pond C-1 bottom sediments should be a combination of both historical and recent data.

2.6.2 Stage 3

Stage 3 activities related to the investigation of Ponds C-1 and C-2 consisted of additional surface-water and sediment sampling and the installation and monitoring of well points along Woman Creek and its tributaries.

2.6.2.1 Surface Water and Sediment Sampling

The OU5 Work Plan stipulated the collection of surface-water and sediment samples as part of the Phase I investigation of Ponds C-1 and C-2. Although a TM was not explicitly called for in the Work Plan, it did imply that this sample collection program may require modification based upon the review of existing data (Section 2.6.1). TM1 (EG&G 1993a) was prepared to provide a revised FSP for the Stage 3 investigation of these IHSSs. This TM also addressed surface-water and sediment monitoring activities for all OU5 IHSSs (Section 2.4.3.4).

2.6.2.1.1 Introduction

OU5-FSP-related field investigations were conducted between October 1992 and May 1993 (EG&G, 1993a, as amended; 1994a).

2.6.2.1.2 Sampling Procedures

Surface-Water Quality. In collaboration with the OU5-FSP low-flow investigations, Microtox and acute-toxicity tests were conducted on two deep-interval C-series ponds' bottom-sediment samples collected during November 9-10, 1992 (EG&G, 1994a, Tables 2C and 2D). Details of the toxicity-related sampling surveys and associated analyses are documented by The Seacrest Group (1992, 1993a, 1993b). OU5-FSP-related results are summarized in EG&G (1994a, Table 9).

The OU5 FSP (EG&G, 1993a, amended) included data collection for the C-series ponds, consisting of a single pond-sediment survey at each of three locations for Ponds C-1 and C-2 and two HydroLab quarterly surveys at the deepest point of Pond C-1 only (sufficient ancillary historical data were judged generally to be available for Pond C-2; see EG&G (1993a, as amended; 1994a)). The C-series ponds' sediment surveys were conducted during November 9-10, 1992 (see below); micro- and acute-toxicity sediment samples were collected at deepest depths of each pond (see Table 2.4.3.4-3). Analytical methodologies for these toxicity protocols are described in Wolaver and Spence (1993) (see EG&G, 1994a, Section 2.1.2). Regarding the Pond C-1 Hydrolab surveys, this location was designated as site SW-C1 (see Figure 2.4.3.4-1) and is concurrent with pond-sediment sampling point SED510 (see Table 2.4.3.4-2). The HydroLab data were obtained at various depths in order to develop a pond water-column profiles. The first HydroLab survey was conducted during November 9, 1992, by EG&G's

surface-water monitoring-program subcontractor and the second HydroLab survey was conducted on April 5, 1993 by subcontractor personnel. Each survey consisted of obtaining field measurements for pH, specific conductance, water temperature, dissolved oxygen (DO) concentration, DO percent saturation (computed), and redox potential (EG&G, 1994a, Appendix Table J-5).

Pond-Bottom Sediments. The pond bottom-sediment-sample survey consists of a one-time sample collection at three locations in both Pond C-1 and Pond C-2. These locations were located at 5-ft from the inlet, the mid-point, and the deepest point in each pond. The locations within Pond C-1 were designated as sites SED508, SED509, and SED510, respectively, and the locations within Pond C-2 have been designated as SED511, SED512, and SED513, respectively (see Tables 2.4.3.4-1 through 2.4.3.4-4). General C-pond locations relative to the Woman Creek drainage are indicated on Figure 2.4.3.4-1.

The OU5 FSP (EG&G, 1993a, amended) specified the top 6-inches of pond-bottom sediment to be analyzed for five general categories of chemical constituents (see Table 2.4.3.4-3); that is, TAL metals, radionuclides, VOCs, various miscellaneous sediment-quality variables, and micro/acute toxicity. In Pond C-1, sediment cores were taken to a depth of 12 inches, with the top 6 inches analyzed for TAL metals, radionuclides, VOCs, and miscellaneous sediment-quality variable. The bottom 6 inches of each core was analyzed for radionuclides only. In Pond C-2, no sediment core exceeded 6-inches in length; therefore, no core-sample segments were analyzed individually (EG&G, 1993a, amended).

The single C-pond bottom-sediments sampling survey was conducted during November 9-10, 1992. Core samples were collected at all six sampling locations for the VOC analyses (see Table 2.4.3.4-4). For the TAL metals, radionuclides, SVOCs, nitrate/nitrites, and micro/acute toxicity analyses, the sediment samples were collected using an Eckman dredge. The sample numbers associated with the three Pond C-1 pond bottom-sediment samples were SD50014WC, SD50016WC, and SD50017WC; for Pond C-2, the sample numbers were SD50023WC through SD50025WC (see Table 2.4.3.4-4). Samples SD50013WC and SD50015WC consisted of quality-control samples associated with sample location SED508.

2.6.2.1.3 Results

The available analytical results were obtained from EG&G's RFEDS with a retrieval dated August 5, 1993 (EG&G, 1994a, Appendix J). Radionuclide laboratory results were received for only sampling locations SED510 and SED513 (EG&G, 1994a, Appendix Table J-1). Based on analyses specified in the FSP, all laboratory data for the pond-bottom-sediments survey have been received for TAL metals, nitrate/nitrites, and VOCs (EG&G, 1994a, Appendix Tables J-2, J-3, J-4A, and J-4B).

Surface-Water Quality. Field water-quality data collected with the HydroLab portable monitor were analyzed for Ponds C-1 and C-2 by plotting profiles of pH, specific conductance, dissolved oxygen, and water temperature with depth for various times of the year. These profiles give an indication of the behavior of the C-ponds relative to internal water-quality characteristics. Pond C-1 profile data are available for November 9, 1992; April 5, 1993; and October 12, 1993. Pond C-2 profile data are available for August 5, 1993; August 31, 1993; and October 12, 1993. Figures 2.6.2.1-1 and 2.6.2.1-2 show Pond C-1 and Pond C-2 profiles for pH, specific conductance, dissolved oxygen, and water temperature, respectively, for the various times during the 1992-1993 sampling period.

For Pond C-1, values of pH, specific conductance, dissolved oxygen, and water temperature (Figure 2.6.2.1-1) are invariant over with depth during all three sampling times. This indicates that Pond C-1 is well mixed and does not stratify either thermally or chemically, as would be expected for this shallow, on-channel pond. Profile results for Pond C-2 (Figure 2.6.2.1-2) are similar to those for Pond C-1, even though Pond C-2 is an off-channel pond.

General conclusions from the 1992-1993 C-pond profiles are that relatively constant conditions exist with depth during the months of April, August, October, and November. It is further concluded that both thermal and chemical stratification of the C-ponds is very weak to non-existent during all months of the year.

Pond-Bottom Sediments. The one-time FSP Ponds C-1 and C-2 bottom-sediment quality data were assessed to determine which sediment-quality constituents may constitute site contaminants. Because no BUTLs are available specifically for pond-bottom sediments at RFP, BUTLs for stream sediments were used to judge whether site contaminants exist in the Pond C-1 and C-2 sediments. Table 2.6.2.1-1 summarizes the FSP TAL-metals, radionuclides, organic compounds, and miscellaneous sediment-quality variables which had concentrations higher than BUTLs.

Analysis of Table 2.6.2.1-1 indicates that selected trace-metal concentrations were higher than the BUTL for similar stream sediments at RFP. Mercury concentrations were higher than the BUTL for all three sampling locations in both Ponds C-1 and C-2. However, these mercury concentrations were accepted as site contaminants, based upon the fact that both the spiked sample recovery and a duplicate analysis were outside the control limits for the test. Therefore, these estimated values of mercury concentration could be laboratory errors. The barium concentration in one sample in Pond C-1 was slightly higher (262 mg/kg) than the BUTL (254 mg/kg). In Pond C-2, calcium and zinc concentrations in each of two samples exceeded the corresponding BUTLs. No samples in either pond had concentrations of radionuclides higher than BUTLs. Pond C-1 had one sample with a TOC concentration (29,000 mg/kg) higher than the maximum background concentration of 24,000 mg/kg. Because only one TOC sample was available for the background sample population (EG&G, 1993i), the significance of this result is questionable. All bottom-sediment samples in Ponds C-1 and C-2 had toluene concentrations which were above the analytical detection limit. In addition, both ponds had bottom-sediment concentrations of five other VOCs which were detected by the mass spectrometer but were well below detection limits. These VOCs have not been included in Table 2.6.2.1-1, because they were below the detection limit and the concentration values were estimates which are judged to be inaccurate.

Based upon the FSP pond-sediment concentrations, it is concluded that contaminants in the pond sediments may consist of mercury, barium, calcium, and zinc. Further statistical tests will be undertaken to assess, based upon the available limited database, if these small number of BUTL exceedance concentrations actually constitute potential Pond C-1 and C-2 contaminants, or if uncertainties in both the actual and background data only make it appear that these concentrations can be concluded to be site contaminants.

2.6.2.2 Well Point Installation and Monitoring

This section discusses the installation and monitoring of well points installed along Woman Creek and its tributaries.

2.6.2.2.1 Introduction

Interactions of surface water and groundwater along Woman Creek have been historically inferred from informal observations that sections of the Creek gain and lose water as the Creek transverses RFP. The variation in gaining and losing water quantities is most likely transient; that is, it varies during the year and from year-to-year, depending upon the streamflows and positions of the water table in the Woman Creek alluvial deposits. Delineation and quantification of surface-water/groundwater interactions in Woman Creek and in OU5 in particular, is important for surface-water, groundwater, and risk-assessment modeling (EG&G, 1993l).

Stream-reach gain/loss studies along Woman Creek, Mower Ditch, and selected tributaries, have been done by CSU (Fedors and Warner, 1993; EG&G, 1992i), and interim study results are discussed in TM1 and associated documents (EG&G, 1992j, 1993a, 1993j). Data and results of gain/loss streamflow measurements in Woman Creek were reported by Fedors and Warner (1993) for the period August 1991 through September 1992. Since that time, EG&G has continued the streamflow gain/loss measurements.

In March 1993, 36 well points were installed as outlined in TM1 (EG&G, 1993a, amended), along Woman Creek. The locations of these well points are shown on Figure 2.6.2.2-1. The well points were located to coincide with Woman Creek channel gain/loss sites used to measure streamflows in Woman Creek by CSU and EG&G. The locations where well points differ from gain/loss measurement sites are noted on Figure 2.6.2.2-1. In addition to well points along Woman Creek at streamflow gain/loss measurement locations, lines of well points perpendicular to Woman Creek were installed at three locations, based upon TM1 (EG&G, 1993a, amended) and field conditions. The locations of these lines of well points also are shown on Figure

2.6.2.2-1. TM1 originally called for three lines of well points located (1) from Woman Creek north toward the Ash Pits (IHSS 133 area, wellpoints 51593 through 52193); (2) from Woman Creek north to the SID near Antelope Spring Creek confluence (well points 52793 through 53293); and (3) from Woman Creek north to the SID generally between Pond C-1 and the Woman Creek Diversion (well points 53993 through 54493). During installation of the well points, field conditions indicated that the line of well points from Woman Creek north to the Ash Pits (well points 51593 through 52193) was an acceptable location. However, the other two lines were moved to reflect areas of data needs. Line 2 was moved upstream and located from Woman Creek north to the Original Landfill (IHSS 115) (well points 52793 through 53293), and Line 3 was moved upstream from Pond C-1 from Woman Creek to the SID in a seep area of water apparently flowing beneath the SID (well points 53993 through 54493).

Although TM1 (EG&G, 1993a, amended) envisioned the well points would be constructed of between 3/4-inch and 1-1/2-inch galvanized pipe driven into the Woman Creek, the final well points were constructed using Easi-Wells by GEO Corporation. A DCN to SOP GT.06 was prepared for installation of the well points. The well points are constructed of 3/8-inch diameter polyethylene tubing, the bottom 2 to 3 ft of which is perforated. The well points are sand packed to within approximately 6 inches of the ground surface and bentonite sealed. A concrete pad surrounds the well point at the ground surface. Water-level measurements are made in the well points using a differential manometer. Measurements of water levels in the well points were made monthly between March 1993 and February 1994.

These 36 shallow well points were used to confirm if gaining and losing reaches of Woman Creek were based upon the head difference in the shallow alluvial groundwater and the water-surface elevations in Woman Creek adjacent to the well point as conceptually defined on Figure 2.6.2.2-1. Gain/loss streamflow measurements were made concurrently with the monthly well-point water-level measurements. The purpose of these data was to help calibrate both the groundwater and surface-water models to be used for OU5 and provide as assessment of the potential for contaminants to move between the shallow alluvial groundwater and surface-water systems. Results of the well point and gain/loss measurements are presented in Appendix H of EG&G (1994a). These groundwater/surface-water interaction data are assessed in the following sections.

2.6.2.2.2 Field Procedures

Installation of the well points at the locations shown on Figure 2.6.2.2-1 were done in accordance with SOP GT.06, DCN 93.02. Details of the installation procedure can be found in this SOP. The horizontal location of each well point and the elevation of the top of each well point protective casing were surveyed. Water-level measurements in the well points were made monthly at the same time as EG&G gain/loss surface-water flow measurements in Woman Creek. Water-level measurement procedures for the well points can be found in SOP GW.01, DCN 93.01. In addition, the elevation difference between the top each well point casing and the water-level in Woman Creek was measured each month at each well point using a hand level and a graduated survey rod. In this way the elevation difference between the water surface in Woman Creek and alluvial groundwater surface could be calculated. If the alluvial groundwater elevation was less than the water-surface elevation in Woman Creek at the well point, then Woman Creek was assumed to be losing water to the alluvium at that well point (Figure 2.6.2.2-2). Conversely, if the alluvial groundwater surface elevation was higher than the Woman Creek stream surface elevation at the well point, then Woman Creek was assumed to gaining water from the alluvium at the well point (Figure 2.6.2.2-2). In this way, the cause-and-effect relationship between Woman Creek and the underlying alluvial groundwater could be determined when the well point data were used in conjunction with the gain/loss measurements in Woman

Creek. The concurrent measurements of the well points and the gain/loss flows were conducted monthly over the period March 1993 through February 1994--a 12-month period. It is believed that this 12-month period is sufficient to see general seasonal variations and, when coupled with previous gain/loss results (Fedors and Warner, 1993), permitted the analysis of preliminary groundwater/surface-water interactions for the Woman Creek basin. Results of the 12-month monitoring effort for the well points are shown in EG&G (1994a, Appendix Tables H-2A through H-2L) and for the gain/loss measurements in EG&G (1994a, Appendix Tables H-3A through H-3K). No data are available yet for the months of January and February 1994.

2.6.2.2.3 Results

Groundwater/surface-water interaction data analyzed for OU5 include both well point and stream water-surface elevation data and gain/loss flow measurements for the period March 1993 through February 1994. The results of this data analysis describes reaches of Woman Creek which are gaining (water flowing from the shallow groundwater system into Woman Creek) or losing (water flowing from Woman Creek into the shallow groundwater system). Woman Creek and its tributaries have been broken into 20 reaches upstream from Pond C-2 (Figure 2.6.2.2-1). Results of the well-point and stream water-surface elevation monitoring in these reaches are summarized in EG&G (1994a, Appendix Table H-2). Gain-loss monitoring for the same periods are shown in EG&G (1994a, Appendix Table H-3). For the well-point/stream water-surface elevation monitoring, a reach was assumed to be gaining if the average of the upstream and downstream groundwater minus surface-water elevations were positive (that is, flow was occurring from the shallow groundwater system into Woman Creek), and assumed to be losing if the average of the upstream and downstream difference in groundwater and surface-water elevations was negative. These interpretations of gaining and losing reaches were compared to gain/loss measurements of flow in Woman Creek at the ends of the same reaches. Using the flow measurements, a reach was assumed to be gaining if the flow rate at the downstream end of the reach was larger than the flow rate at the upstream end of the reach, and losing if the downstream flow rate was less than the upstream flow rate.

A comparison of the two methods of analyzing gaining and losing reaches in Woman Creek are given in Table 2.6.2.2-1 (*revised* from EG&G, 1993j, Table 12). In all but 13 of the 64 data comparisons between well point/surface-water elevations and gain/loss flow measurements during the concurrent measurement period, the reaches are characterized identically as gaining or losing. For the 13 cases where one method defined the reach as different from the other method, no explanation could be given for this difference, except unknown changes within the reach that may account for the difference. This indicates that the cause of the gaining and losing reaches in Woman Creek is closely linked with the shallow groundwater system.

Based upon data collected during the December 1991 through October 1992 period (Fedors and Warner, 1993) and during the March 1993 through February 1994 period, the individual reaches of Woman Creek can be characterized as generally gaining or losing water during certain period of the year. Two reaches of Woman Creek and its tributaries can be identified as generally gaining water from the shallow groundwater system on nearly a year-round basis. These reaches include 52793-53393 and 54693-54793 (Figure 2.6.2.2-1). Of note is the fact that the gaining reach 52793-53393 is adjacent to IHSS 115, the Original Landfill, and reach 54693-54793 is downgradient from the old firing range. These gaining reaches may be significant receptors of contaminants from known sources within the Original Landfill and OU2, respectively. Another interesting reach is reach 53393-53493, immediately downstream from reach 52793-53393, which is losing in all months except January and February. The reach 52393-52293 also appears to be gaining for nearly all months where data are available; however, no dry stream-channel conditions are often present during the summer months (June through September) within this reach. Reach 52493-52393 is often dry and not much data are available for this reach. Many reaches appear to be gaining during the winter and spring (October through May) period but losing during the summer and fall months (July through September). Those reaches include 51293-51393, 51393-51493, 51493-51593, 51593+52293-52593, 52593-52793, 53493-53593, 53793-53693, 53993-54593, and 54693-54793. Other reaches gain for several months or less and then lose the rest of the year (reaches 53593+53693-53893, 53893-53993, and 53993-54593). Reach 54593-54693, downstream from Pond C-1 appears to be a gaining reach into late summer (April through July), possibly because of water stored in Pond C-1, but losing the rest of the year. The data presented herein generally support the conclusions of Fedors and Warner (1993), as augmented by gain/loss data on Woman Creek (Berzins, EG&G-EM/SWD, pers. comm., 1993).

2.6.3 Stage 4

Stage 4 activities at IHSSs 142.10 and 142.11 consisted of the installation and sampling of groundwater monitoring wells.

2.6.3.1 Groundwater Investigation

This section discusses the drilling, installation, and sampling of groundwater monitoring wells at IHSSs 142.10 and 142.11. This section also discusses the results of aquifer tests at Pond C-1.

2.6.3.1.1 Introduction

According to the OU5 Work Plan (DOE, 1992a), four monitoring wells were to be installed below IHSSs 142.10 and 142.11 as part of the OU5 Phase I RFI/RI. The OU5 Work Plan

(DOE, 1992a) did not include any preliminary survey activities to be performed at this IHSS to guide the monitoring well installation program. Two wells were to be installed immediately downgradient of each dam at Ponds C-1 and C-2 to monitor the saturated alluvium (Figure 2.6.3.1-1). All of these wells were installed in accordance with the OU5 Work Plan (DOE,1992). One well, 51193, was selected for field characterization of aquifer parameters.

2.6.3.1.2 Field Procedures

Hollow-stem augers were used for advancing the boreholes in which the four wells (50092, 50192, 50292, and 51192) were installed in accordance with SOP GT.02. The borings were drilled approximately 5 ft into weathered bedrock, in accordance with the OU5 Work Plan (DOE, 1992a). During the drilling of the boreholes, soil samples were collected for environmental analysis. The sampling technique employed involved driving a split-spoon sampler with a 140-pound slide hammer to collect the soil samples. Once the sampler was removed from the borehole and opened, its contents were scanned with an alpha and a beta/gamma probe to detect radioactivity, and an OVM to detect VOCs. The recovered core was then measured, examined visually, and the lithology was classified and logged.

Although it was not specified in the OU5 Work Plan (DOE, 1992a), discrete soil samples were collected at 5-foot intervals, down to the first bedrock interval. These samples were collected in 3-inch stainless-steel liners for analysis of TCL VOCs. The collection of these soil samples was in accordance with EG&G personnel direction. Continuous core was collected from each borehole in 2-foot intervals. Once the samples were obtained, the core was placed in core-storage boxes. It was later more rigorously examined and classified utilizing sieves and other equipment at a designated logging facility, as required in SOP GT.01.

Following the completion of a boring, 2-inch inside diameter PVC wells were installed in accordance with SOP GT.06. These wells were constructed inside the 6-¼-inch inside diameter hollow-stem augers. The bottom of the screened interval was located at or near the bedrock/alluvium contact. Five-foot well screens were installed in wells 50093 through 50393 and a 2.5-ft well screen was installed in well 51193 (Figures 2.6.3.1-2 and 2.6.3.1-3). Silica sand was installed within the annulus between the boreholes and the well casings from just below the bottom of the screened intervals to from 1.15 to 2 ft above the top of the screened intervals. Bentonite seals were installed above the filter packs at thicknesses ranging from 1.7 to 2.1 ft. Each well was then completed by filling the remaining annulus with concrete; installing a steel, locking, protective casing; and constructing a 3- by 3-foot concrete pad around the protective casing.

All of the wells installed below IHSSs 142.10 and 142.11 are being sampled on a quarterly basis. The first round of quarterly sampling at wells 50092, 50192, and 50292 was conducted during November 1992. Well 51193 was first sampled during January 1993. If enough groundwater is present at the time of sampling, groundwater samples are analyzed for unfiltered total chromium, beryllium, tritium, nitrogen, gross alpha, gross beta, uranium-233/234, uranium-235, uranium-238, plutonium-239/240, americium-241, TAL metals, TCL VOCs, TCL SVOCs; and filtered total uranium, plutonium-239/240, cesium-137, strontium-89/90, americium-241, TAL metals, beryllium, anions, and TDS.

Based on development and sampling histories, only well 51193 below IHSS 142 appeared to be productive enough to warrant aquifer testing (Figure 2.6.3.1-4). The unconsolidated material of well 51193 consists of gravelly clay underlain by over 3 ft of gravelly sand and gravel. Bedrock occurs at 7.1 ft in well 51193. Depth to bedrock varies from 4 ft in well 63393 to 9.5 ft in well 63493 (Figure 2.6.3.1-5). The unconsolidated materials of wells 63293 and 63493 included some sand and gravel layers. With bedrock at 4 ft, the static water level in well 63393 was just below the silty claystone bedrock and was therefore not expected to respond to pumping. Three 0.5-inch well points were installed as observation wells (63293, 63393 and 63493) at 3.7, 8.6, and 6.4 ft, respectively, from the pumping well 51193 (Figures 2.6.3.1-3 and 2.6.3.1-4). The installation of these well points is discussed in Section 2.4.4.2.2. The observation wells were developed using the "rawhiding" method described in Section 2.4.4.3.2, and the pumping well was developed according to SOP GW.02.

Prior to the aquifer pumping test, a step test was performed with a peristaltic pump at well 51193. This was done to gather preliminary aquifer data in order to determine optimum pumping rates for the pumping test. The results indicated that a peristaltic pump with a maximum pumping rate of 0.18 gpm was appropriate for the aquifer pumping test. When this test was performed, the water level in the pumping well was monitored electronically with a transducer and by hand using a standard water level indicator. Water levels in wells 63293 and 63493 were measured by hand with Slope Indicator meters. The most distant well, 63393, was monitored with a manometer. The drawdown was monitored for 133 minutes, the pump was then shut down, and recovering water levels monitored.

2.6.3.1.3 Results

The recovered core was visually logged as the boreholes were advanced, according to SOP GT.01. It was later more closely examined and classified utilizing sieves and other equipment at a designated logging facility, as required in SOP GT.01. The results of this effort indicated that the bedrock encountered in all of the wells was claystone. The thickness of the alluvial material encountered in boreholes 50092, 50192, and 50392 was approximately 10 ft. The thickness of the alluvial material encountered in well 51193 was 7.1 ft (Figures 2.6.3.1-2 and 2.6.3.1-3).

Groundwater was not encountered during drilling in boreholes 50092, 50192, and 50292. However, during subsequent rounds of quarterly water level measurements, well 50092 contained water, while wells 50192 and 50292 remain dry (Figure 2.6.3.1-2). Groundwater was encountered during drilling in well 51193 at 4 ft, and this well has continued to contain water.

During the drilling of these boreholes, field monitoring, as described in Section 2.6.3.1.2, was conducted on the core. The monitoring results from the OVM, the alpha and beta/gamma probes, and radiation smears were all below background levels.

Monitoring Well Borehole Soil Samples. The analytical results from the soil samples collected from the IHSS 142 monitoring well boreholes available as of January 28, 1994 include TAL metals, radionuclides, pesticides, PCBs, SVOCs, and VOCs. Table 2.6.3.1-1 summarizes the results for constituents present in concentrations exceeding BUTLs.

Metals. None of the soil samples collected from the boreholes in which monitoring wells were installed in IHSS 142 contained TAL metal constituent concentrations exceeding BUTLs.

Radionuclides. Two samples from the boreholes in which groundwater monitoring wells were installed in IHSS 142 had radionuclide constituent concentrations exceeding BUTLs. Plutonium-239/240 was detected in a drum characterization sample collected from well 50192 at 0 to 15 ft and in a sample from well 51193 at 0 to 15 ft at concentrations exceeding BUTLs. The concentrations in these samples were 0.098 and 0.16 pCi/g, respectively. These concentrations were also greater than the maximum background concentrations. Americium-241 was detected in the sample from well 50192 at a concentration exceeding the BUTL (0.020 pCi/g) and the maximum background concentration.

Pesticides and Polychlorinated Biphenyls (PCBs). None of the soil samples collected from the IHSS 142 monitoring well boreholes contained pesticide or PCB constituent concentrations exceeding BUTLs.

Semi-Volatile Organic Compounds. No identified SVOCs were detected in soil samples collected from any of the IHSS 142 monitoring well boreholes. However, TICs were detected in soil samples from all four of the groundwater monitoring well boreholes. A drum characterization sample collected from well 50092 at 0 to 15 ft contained three TICs ranging in concentration from 620 to 29,000 μg/kg. A drum characterization sample collected from well 50192 at 0 to 15 ft contained five TICs ranging in concentration from 620 to 25,000 μg/kg. A sample collected from well 50292 at 0 to 10 ft contained two TICs at concentrations of 18,000 and 390 μg/kg. A sample collected from well 51192 at 0 to 10 ft contained five TICs at concentrations ranging from 350 to 12,000 μg/kg). The concentrations reported for these TICs are estimates as the concentrations were below the sample's detection limit.

Volatile Organic Compounds. VOCs were detected in soil samples collected from all four monitoring well boreholes in IHSS 142. One soil sample collected from monitoring well borehole 50092 at 10 to 10.25 ft contained methylene chloride and toluene at concentrations of 4 and 3 μg/kg, respectively. A second sample, collected from a depth of 4.9 to 5.15 ft, contained toluene at a concentration of 21 μg/kg. Two soil samples collected from monitoring well 50192 at depths of 4.75 to 5 and 9.6 to 9.9 ft contained toluene at concentrations of 3 and 12 μg/kg, respectively. Two soil samples collected from monitoring well 50292 at depths of 9.75 to 10 and 4.75 to 5 ft contained toluene at concentrations of 23 and 22 μg/kg, respectively.

Two soil samples collected from monitoring well borehole 51193 at depths of 5.75 to 6 and 9.75 to 10 ft contained toluene and acetone at concentrations of 9 and 5 μg/kg, respectively and toluene, methylene chloride, and acetone at concentrations of 3, 2, and 4 μg/kg, respectively.

In addition to the VOCs discussed above, a TIC was detected in a sample collected from monitoring well borehole 51193 at a depth of 9.75 to 10 ft. The concentration was below the sample's detection limit, however, it was estimated at 11 μg/kg. One TIC was also found in a rinsate sample taken during drilling and sampling activities at this location on January 5, 1993 at a concentration of 19 μg/L.

Monitoring Well Groundwater Samples. The analytical results from the groundwater collected from the IHSS 142 monitoring wells available as of January 28, 1994 include TAL metals, radionuclides, pesticides, PCBs, SVOCs, and VOCs. Table 2.6.3.1-2 summarizes the results for constituents detected at concentrations exceeding BUTLs.

Metals. Three groundwater samples collected from IHSS 142 had TAL metal constituent concentrations exceeding BUTLs. Two of these samples were collected from well 51193. A sample collected on March 20, 1993 contained 13 constituents (aluminum, barium, chromium, cobalt, copper, iron, lead, manganese, nickel, potassium, vanadium, zinc, and silicon) exceeding BUTLs. A sample collected on April 26, 1993 from this same well contained only three constituents (barium, iron, and manganese) exceeding BUTLs. A sample collected from well 50092 contained two constituents (barium and potassium) exceeding BUTLs.

Radionuclides. Two groundwater samples collected from the IHSS 142 wells had a radionuclide constituent concentration exceeding the BUTL. One sample, collected from well 51193 on August 16, 1993 contained radium-226 at a concentration of 1.55 pCi/L. One filtered sample taken from well 50092 on June 15, 1993 contained gross beta at a concentration of 230 pCi/L. These concentrations are greater than both their respective BUTLs and maximum background concentrations.

Water Quality Parameters. Water quality analyses resulted in parameters exceeding BUTLs in wells 50093 and 51193. A sample taken from well 50092 on March 21, 1993 contained a chloride concentration (42.7 mg/l) only slightly greater than the BUTL (42.4 mg/L) but well below maximum background concentrations (118,000 mg/L). A sample taken from well 51193 on March 20, 1993 contained a total suspended solids concentration of 1,300 mg/L. Again, this concentration is greater than the BUTL (1,134 mg/L) but was well below maximum background concentration (6,400,000 mg/L).

Pesticides and Polychlorinated Biphenyls (PCBs). None of the groundwater samples collected from the IHSS 142 monitoring wells contained detectible concentrations of pesticides or PCBs.

Semi-Volatile Organic Compounds. One groundwater sample collected to date from IHSS 142 groundwater monitoring wells had detectible SVOCs. A sample collected from well 51193 on May 6, 1993 contained pyrene, benzo(a)anthracene, and chrysene at concentrations of 4, 4.5, and 4.5 μg/L, respectively.

In addition, two TICs were detected in groundwater samples collected from two groundwater monitoring wells in IHSS 142. A groundwater sample collected on April 27, 1993 from well 50092 contained 2-pentanone and 4-hydroxy-4-met at an estimated concentration of 22 μg/L. Another groundwater sample collected on April 26, 1993 from well 51193 contained the same TIC at an estimated concentration of 34 μg/L.

Volatile Organic Compounds. None of the groundwater samples collected to date from IHSS 142 groundwater monitoring wells contained detectible concentrations of VOCs.

Aquifer Test Results. Table 2.6.3.1-3 provides a summary of the IHSS 142 aquifer test analyses. The aquifer test analysis computer software AQTESOLV (Geraghty & Miller, 1989) was used to perform these aquifer test analyses. The aquifer test data from pumping well 51193 and from observation wells 63293 and 63493 were analyzed by the Theis (1935) method (Figures 2.6.3.1-6 and 2.6.3.1-7). As expected, no drawdown was observed in well 63393. The results of the analyses were similar with transmissivities in the range of 0.021 to 0.030 square ft per minute (Figures 2.6.3.1-6 and 2.6.3.1-7).

2.7 IHSS 209 AND OTHER SURFACE DISTURBANCES

The following sections discuss the results of the Phase I RFI/RI activities conducted at IHSS 209, the Surface Disturbance West of IHSS 209, and the Surface Disturbance South of the Ash Pits.

2.7.1 Stage 1 - Aerial Photograph Review

In accordance with the OU5 Work Plan, a review of aerial photographs and oblique photographs covering IHSS 209 and the two other surface disturbance areas was completed on September 23, 1992. The results of the aerial photograph review are summarized in the following sections. The aerial photographs used for this review were those contained in EPA (1988). The oblique photographs that were reviewed are photographs dated from 1969 to the late 1980s. The photographs were examined to assess the location and history of the surface disturbances. The results of this review are presented below.

2.7.1.1 IHSS 209

IHSS 209 consists of disturbed ground, as shown on Figure 1.2-4, that extends from the southwest to the northeast for a distance of approximately 1,200 ft and two ponds. The aerial photographs indicate that the vegetation and upper sediments had been stripped from the area prior to 1955, and prior to 1964, several pits had been opened within the site. The review of the photographs subsequently resulted in an extension of the overall length of the IHSS as compared to the dimensions shown on Figure 2-7 of the OU5 Work Plan, and some adjustments to the locations of the pits that were also shown on Figure 2-7 of the Work Plan. The two pond sites were added to Figure 1.2-4 as a result of Stage 1 activities. The pond, shown on Figure 1.2-4 to the southwest of the road is first visible on the 1980 photograph. The pond, shown on Figure 1.2-4, on the northeast end of the site occurs at the base of a hill and is first visible on the 1955 aerial photograph. The northeast pond was bisected by a road prior to 1964, and currently appears to be a seepage area with abundant vegetation.

2.7.1.2 Surface Disturbance West of IHSS 209

The Surface Disturbance West of IHSS 209 consists of eight pits that are first visible on the 1955 vertical aerial photograph of the RFP area (Figure 1.2-4). The Stage 1 aerial photo review resulted in relocating the pits approximately 250 ft to the north with respect to the locations shown on Figure 2-7 of the OU5 Work Plan. Three additional pits were identified as a result of Stage 1 activities and confirmed during the Stage 2 field reconnaissance (Section 2.7.2).

2.7.1.3 Surface Disturbance South of the Ash Pits

The Surface Disturbance South of the Ash Pits is shown on Figure 1.2-5 and consists of an area of disturbed ground, and an area that contains two open and two reclaimed pits. The area containing the disturbed ground comprises the southwest end of the site and is approximately 1,000 ft in length, and from 50 to 150 ft in width. The open and reclaimed pits are located in the northeast half of the site. The locations of the pits shown on Figure 1.2-5 have been corrected as a result of Stage 1 activities, according to scaled locations from the aerial photographs, and do not agree with the locations shown on Figure 2-6 of the OU5 Work Plan.

2.7.2 Stage 2

Stage 2 activities at IHSS 209 and the other surface disturbances consisted of a visual inspection of each site to confirm the information obtained in Stage 1 and to determine if any debris or staining indicative of waste disposal are present. Stage 2 also involved the performance of surface radiological surveys over each site.

2.7.2.1 Visual Inspection

A visual inspection/site reconnaissance of IHSS 209 and the other surface disturbances was conducted on September 24, 1992. The following sections discuss the results of this inspection for each site.

2.7.2.1.1 IHSS 209

As a result of Stage 2 reconnaissance, the pond southwest of the road was found to be at least 10 ft in depth and dry. The pits shown throughout the area are small, shallow excavations that are still open or partially backfilled. There is no evidence that these pits were ever used for the disposal of waste materials. The Stage 2 field reconnaissance confirmed the overall reconfiguration of the site, resulting from Stage 1 activities, and that no significant debris or staining was found to indicate that any waste disposal had occurred. It appears that the largest disturbance on the northeast end of the area, may have been used as a source of gravel prior to 1955.

2.7.2.1.2 Surface Disturbance West of IHSS 209

The Stage 2 field reconnaissance confirmed the locations of all eight pits identified on the 1955 aerial photograph. The largest pit is located near the center of the site and was found to be several ft deep. The largest pit was dry at the time of the inspection but obviously holds water during periods of wet weather or snow melt, and is now the host for a fairly large cottonwood tree indicating that the sight has been open for a long period of time. The remaining pits are small and shallow, appear to be capable of holding water during wet weather, and are heavily revegetated. There is no indication that any of these pits had ever been used as disposal sites. It is unclear what use the pits may have served. As stated in Section 1.2.1.4, the OU5 Work Plan speculated that these pits may have been part of a planned radio-tower installation. The reconfiguration of these pits and the fact that the pits are located on a hillside rather than the top of the hill indicates that this may not be the case.

2.7.2.1.3 Surface Disturbance South of the Ash Pits

The field reconnaissance of the Surface Disturbance South of the Ash Pits confirmed the existence of the features noted in the OU5 Work Plan and identified on the aerial photographs. The disturbed area located in the southwest half of the site consists of cobble and small boulder size rocks of the Rocky Flats Alluvium, and appear to have been disturbed by some unknown surface activity. There is, however, no staining or debris associated with the site that would indicate any waste disposal had occurred.

The smaller pits shown on Figure 1.2-5 are both open. The pit shown on the southwest end of the site is a drainage ditch that diverts runoff water to the south and shows no indications as having been used as a disposal site. The open pit shown on the northeast end of the site is approximately 20 ft in length, 2 to 3 ft deep, and shows no indications as having been used as a disposal site. The northeast pit is located directly to the northeast of the current location of a radio relay transmitter.

The elongated parallel pits shown on Figure 1.2-5, were opened prior to 1978 and were apparently reclaimed soon after that time. The area was recontoured and is now completely re-vegetated. There are no indications of debris or staining associated with these sites.

No evidence was found, as a result of the Stage 1 and 2 activities, to support the existence of the horseshoe-shaped pit described in the OU5 Work Plan. Topographically, this area of the site is an elongated northeast trending nose with moderately steep slopes defining the northeast end of the structure. The alluvial materials exposed along these slopes can account for the appearance of a pit or disturbed area on the aerial photographs; however, Stage 2 field reconnaissance did not substantiate the existence of a horseshoe-shaped pit.

2.7.2.2 FIDLER Surveys

Section 7.2.4 of the OU5 Work Plan specified that IHSS 209 and the other surface disturbances be surveyed with a FIDLER. The results of this survey were to be used to modify, if necessary, the Stage 3 sampling activities at these sites.

2.7.2.2.1 Introduction

The surface radiological survey specified by the OU5 Work Plan was to be performed randomly at each of the surface disturbance sites. However, to ensure that the survey of each site was thorough, the surveys were performed using a grid as discussed in Section 2.7.2.2.2. The surface radiological surveys were conducted after the Stage 1 activities (Section 2.7.1) and the Stage 2 visual inspection (Section 2.7.2.1) were completed.

2.7.2.2.2 Survey Procedures

The surface radiological surveys of IHSS 209 and the other surface disturbances were performed in accordance with SOP FO.16, as amended by DCN 93.01. The surveys were performed using a FIDLER on a grid with a line spacing of 20 ft. Each line was walked slowly while observing the display of the FIDLER for any deflection from background levels. If a deflection from background was observed, the survey would be confined to a smaller area in an attempt to identify the source(s) of the anomalous readings. In addition, 1-minute scaler readings were taken with the FIDLER at points placed on a 40-foot triangular grid. Every open pit at the sites was also surveyed by slowly surveying the interior of the pit with the FIDLER and by taking 1-minute scaler readings near the center of the pit. The pond/seep area located on the northeast side of IHSS 209 was also surveyed randomly.

2.7.2.2.3 Results

The FIDLER surveys of IHSS 209 and the other surface disturbances did not identify any areas of above-background radiation. The results of these surveys, including the activities measured by each 1-minute scaler reading, are presented in Figure 2.7.2.2-1 for IHSS 209, Figure 2.7.2.2-2 for the Surface Disturbance West of IHSS 209, and Figure 2.7.2.2-3 for the Surface Disturbance South of the Ash Pits. The random survey of the pond/seep area on the northeast side of IHSS 209 also did not indicate any above-background levels of radiation. The results of these surveys, therefore, did not necessitate any modifications to the Stage 3 sampling activities discussed in the following sections.

2.7.3 Stage 3

Stage 3 activities at IHSS 209 and the other surface disturbances consisted of the collection of surface and subsurface soils. Samples of surface water and sediments in the water-filled pits at IHSS 209 were also collected under Stage 3.

2.7.3.1 Surface Water and Sediment Sampling

The OU5 Work Plan specified the collection of samples of surface water, if present, and sediments from the pond-like depressions at IHSS 209. This section discusses the collection and analysis of surface-water samples from these locations. "Sediment" samples were collected from these depressions when no water was present in them during the surface soil sampling program discussed in Section 2.7.3.2.

2.7.3.1.1 Introduction

Monitoring sites IHSS209 and SW55193 (see Figure 2.4.3.4-1) are both located on a hilltop southeast of Pond C-1 within IHSS 209. Each of these sites constitutes a localized depression which intermittently collects rainfall and snowmelt; samples from these were collected in March and May 1993.

2.7.3.1.2 Sampling Procedures

Other one-time stream/ditch samples were collected at monitoring site IHSS209 on March 18, 1993, and at monitoring site SW55193 on May 24, 1993 (see Table 2.4.3.4-4). These samples were processed for laboratory analyses for the four general categories of chemical constituents as indicated on Table 2.4.3.4-3.

2.7.3.1.3 Results

Analytical results of the single samples are included in EG&G (1993j, Appendix Tables J-1 through J-4). The analytical results have been compared to BUTLs for surface water. No concentrations exceeding BUTLs were noted for radionuclides, trace metals, or priority pollutants (organic constituents) associated with these resultant analyses.

2.7.3.2 Surface Soil Sampling

The OU5 Work Plan specified that surface soil samples be collected from IHSS 209 and the other surface disturbances. This section describes the Stage 3 surface soil sampling activities and the resultant analytical data.

2.7.3.2.1 Introduction

The scope of work for the surface soil sampling program at the surface disturbances is described in the OU5 Work Plan and in TM10. TM10 proposed that 19 surface soil samples be collected at three sites. The sample locations are coincident with pits, former excavation sites or ponds, that were identified during Stage 1 review of aerial photographs. TM10 also proposed that surface soil samples be collected at radiation survey anomalies. A single point FIDLER survey at each site was conducted and no radiation anomalies were detected.

2.7.3.2.2 Sampling Procedures

Sample locations were identified in the field by means of a compass, measuring tape, and with reference to a surveyed baseline. The location of each surface soil sample was staked at the time the sample was collected. The field procedures used to collect surface soil samples were in accordance with the RF Method, Section 5.0 of SOP GT.08. The RF Method is described in Section 2.4.3.1.2.

2.7.3.2.3 Results

Surface soil samples were collected at 19 locations in IHSS 209, the Surface Disturbance West of IHSS 209, and the Surface Disturbance South of the Ash Pits (Figures 2.7.3.2-1A and -1B). The samples were analyzed for TAL metals, radionuclides, pesticides, PCBs, SVOCs, bulk density, particle size, specific conductivity, pH and TOC. The analytical results available as of January 28, 1994 for surface soil and sediment samples are discussed below.

Metals. None of the samples contained metals in concentrations that exceeded the BUTLs. The analytical results from these samples are included in Appendix B.2.

Radionuclides. Eight of the 19 surface soil samples exhibited radioactivity exceeding the BUTL. Plutonium-239/240 exceeded the BUTLs in all eight samples, and americium-241 exceeded the BUTLs in four of the samples. The counting error for two of these samples (SS50089AS - plutonium-239/240 and SS50086 - americium-241) was significant in that the result minus the counting error yields an error compensated result below the BUTL. Analytical results for radionuclide analyses are summarized in Table 2.7.3.2-1, and the sample locations are shown in Figure 2.7.3.2-2.

Pesticides and Polychlorinated Biphenyls (PCBs). None of the surface soil samples exhibit detectable concentrations of pesticides or PCBs. Analytical results for detectable concentrations of pesticides and PCB analyses are given in Appendix B.5.

Semi-Volatile Organic Compounds. Seven surface soil samples contained detectable concentrations of SVOCs. Three samples contained benzoic acid and bis(2-ethylhexyl)phthalate, one sample contained benzoic acid and isophorone, two samples contained only benzoic acid, and one sample contained only bis(2-ethylhexyl)phthalate. The analytical results for these samples are summarized in Table 2.7.3.2-1, and Figure 2.7.3.2-3 gives the locations of these samples.

Volatile Organic Compounds. None of the samples exhibited detectable concentrations of VOCs. The analytical results for VOCs are included in Appendix B.3.

General Chemistry Analyses. Surface soil samples collected in IHSS 209 were analyzed for bulk density, particle size, specific conductivity, pH, and TOC. These parameters were requested by EG&G for use in risk assessment and will provide information pertinent to air transport modeling and contaminant mobility. Analytical results for specific conductivity, pH and TOC are presented in Appendix B.6, and results for the other parameters are included in Appendix E.

2.7.3.3 Soil Borings

This section describes the collection and analysis of subsurface soil samples from borings drilled in IHSS 209 and the other surface disturbances.

2.7.3.3.1 Introduction

The OU5 Work Plan proposed drilling 19 boreholes to a depth of 12 ft within IHSS 209, the Surface Disturbance West of IHSS 209, and the Surface Disturbance South of the Ash Pits (Figures 1.2-4 and 1.2-5). Three borings were to be located in IHSS 209, five borings were to be located in the Surface Disturbance West of IHSS 209, and 11 borings were to be located in the Surface Disturbance South of the Ash Pits.

TM10 was prepared after preliminary investigations were completed at these locations. Based on surface disturbances identified in the aerial photograph review, TM10 proposed drilling only four soil borings (Figures 2.7.3.3-1 and 2.7.3.3-2). These four soil borings were drilled to characterize subsurface materials and to assess if subsurface contamination is present. Preliminary investigation of IHSS 209 indicated that a soil boring, 41191 (Figure 2.7.3.3-1), that was drilled during the Phase II Site Wide Geologic Characterization Program had already been drilled to a depth of 223.1 ft in this IHSS (EG&G, 1993h). During installation of this boring, 6-foot composite samples were collected for analysis of TAL metals and radionuclides, and 2-foot discrete samples were collected for analysis of VOCs. The results of these analyses indicated that nothing out of normal range was detected. Based on the results sample analyses on samples taken during the drilling of this boring, no soil borings were drilled in IHSS 209. However, one soil boring was drilled in the Surface Disturbance West of IHSS 209 (Figure 2.7.3.3-1), and the remaining three soil borings were drilled in the Surface Disturbance South of the Ash Pits (Figure 2.7.3.3-2).

2.7.3.3.2 Drilling and Sampling Procedures

Hollow-stem augers were used for advancing the boreholes using the techniques described in SOP GT.02. Samples were collected in a split-spoon sampler. Once the drive sampler was removed from the borehole and opened, its contents were scanned with an alpha probe and a beta/gamma probe to detect radioactivity, and an OVM to detect VOCs. The amount of recovered core was then measured, examined visually for the presence of waste material, and the lithology was classified and logged.

TM10 specified that soil samples would be collected continuously from ground surface to the first bedrock interval, provided the alluvial material appeared disturbed. If the alluvial material appeared undisturbed, only the top 6 ft of soil would be collected for analyses. Borehole 57693 was the only borehole in which the alluvial material appeared undisturbed. Therefore, three discrete samples were collected at borehole 57693 at 2-foot intervals from the top 6 ft. These samples were collected in 3-inch stainless-steel liners and analyzed for TCL VOCs. In addition, one 6-foot composite sample was collected from depths of 0 to 6 ft and analyzed for TCL SVOCs, TAL metals, total uranium, plutonium, americium, gross alpha, and gross beta, as specified in the OU5 Work Plan (DOE, 1992a).

Boreholes 57793 and 57893 were drilled 6 ft into weathered bedrock. Borehole 57993, located in the Surface Disturbance South of the Ash Pits, was drilled to a depth of 22 ft, never encountering bedrock. This borehole was not drilled deeper because of difficult drilling conditions. For these boreholes, soil samples were collected continuously from ground surface to the first bedrock interval or total depth, whichever came first. Discrete samples were collected in 3-inch stainless steel liners at 2-foot intervals and analyzed for TCL VOCs. In addition, 6-foot composite samples were collected and analyzed for the same constituents as above.

In order to obtain these composite samples of soil core, the recovery was placed in a safe location, out of direct sunlight, until three consecutive 24-inch, or four consecutive 18-inch samples totaling the required 6 ft were collected. The soil was then mixed into a 6-foot composite, and placed in appropriate containers for laboratory analysis according to SOP FO.13.

In addition to the discrete samples and the 6-foot composite samples, 2-foot composite samples were collected from the top 2 ft of each soil boring to assist in the ecological assessment study. Also, soil samples were collected from boreholes 57693, 57893, and 57993 for geotechnical analysis (i.e., grain size), as stipulated in the OU5 Work Plan (DOE, 1992a). The geotechnical samples were collected from the top 2 ft. No groundwater was encountered in these boreholes.

2.7.3.3.3 Results

Boreholes 57693, 57793, 57893, and 57993 were drilled to depths of 6, 33.9, 30.4, and 22 ft, respectively. At borehole 57693, bedrock was encountered at ground surface with no alluvial material present. Bedrock was encountered in boreholes 57793 and 57893 at depths of 30.2 and 24.4 ft, respectively. Bedrock was not encountered at borehole 57993 (Figure 2.7.3.3-3). As mentioned above, this borehole could only be advanced to a depth of 22 ft due to difficult drilling conditions. The bedrock material encountered in boreholes 57693 and 57793 consisted of claystone. The bedrock material encountered in borehole 57893 was clayey sandstone that graded to sandstone. The alluvial material encountered appeared to be the Rocky Flats Alluvium. Groundwater was not encountered during the installation of these boreholes.

Appendix E, Figure E21 presents the results of the geotechnical analyses performed on the soil sample collected from borehole 57693. Soil samples were also collected from boreholes 57893 and 57993 but there was not enough material in those samples to run a grain size analysis. As shown on Figure E21, the results of this sample analysis indicated that the surficial material is poorly graded and fine grained. No gravel was present (none of the sample was retained on the #4 sieve), and only 2.3 percent was sand sized (was retained on the #200 sieve). Since 97.7 percent of the sample was silt/clay sized (passed the #200 sieve), it has been classified as ML/CL using the USCS.

During the drilling of these boreholes, field monitoring, as described in Section 2.7.3.3.2, was conducted on the core. The monitoring results from the OVM, the alpha and beta/gamma probes, and radiation smears were all below background levels.

Analytical results of the constituents detected at concentrations exceeding BUTLs from the soil samples collected from boreholes 57693 through 57993 are summarized on Table 2.7.3.3-1. The available analytical results were obtained from EG&G's RFEDS. The analytical results include TAL metals, radionuclides, pesticides, PCBs, SVOCs, and VOCs.

<u>Metals</u>. As presented on Table 2.7.3.3-1, the metals analyses resulted in one constituent (chromium) being detected at a concentration exceeding BUTLs. Chromium was detected in one

sample at a depth of approximately 5 to 8 ft at borehole 57993. The analysis of this sample resulted in a concentration of 108.25 mg/kg, which is within the range of background concentrations.

Radionuclides. As shown on Table 2.7.3.3-1, the radiological analyses resulted in one sample from borehole 57893 having plutonium-239/240 detected at a concentration exceeding BUTLs (0.0229 pCi/g). This sample was collected from a depth of 12.4 to 18 ft. The plutonium-239/240 concentration detected in this sample is below the BUTL for plutonium-239/240. No other radionuclide constituent was detected exceeding BUTLs from all of the samples collected from boreholes 57693 through 57993.

Pesticides and Polychlorinated Biphenyls (PCBs). The laboratory analyses performed on the soil samples collected from the soil borings installed in these areas did not detect any pesticides or PCBs.

Semi-Volatile Organic Compounds. As presented on Table 2.7.3.3-1, the only compound that was detected in the soil samples collected from these boreholes was benzoic acid. Benzoic acid was detected in soil samples that were collected from boreholes 57693 (depths ranging from 0 to 6 ft), 57793 (depths ranging from 6 to 12 ft and 25 to 29 ft), 57893 (depths ranging from 0 to 6 ft), and 57993 (depths ranging from 0 to 6 ft). The results of these soil samples ranged in concentration from 81 to 260 μg/kg, with the maximum concentration being detected in a soil sample collected from borehole 57693.

Volatile Organic Compounds. As presented on Table 2.7.3.3-1, the compound that was detected in the soil samples collected from these boreholes was methylene chloride. Methylene chloride was detected in soil samples that were collected from boreholes 57793 (depth of 24 ft) and 57893 (depths ranging from 1.5 to about 6 ft). The results of the soil sample collected from borehole 57793 and the sample collected from borehole 57893 were at concentrations below the detection limit. The remaining two samples that detected methylene chloride were at concentrations of 10 and 11 μg/kg.

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Table 2.1-1: Matrix of OU5 RFI/RI FSP Requirements from IAG, Work Plan, and Technical Memoranda

		IAG		WORK PLAN		MODIFIED BY TM		
IHSS	**ACTIVITY**	**TASK**	**Analytes**	**TASK**	**Analytes**	**TASK**	**ANALYTES**	**Comments**
115 Original Landfill	Rad Survey	FIDLER	n/a	HPGE-Fall 90	n/a	Data reviewed in TM 2 FIDLER SURVEY over hot spots	n/a	
	Magnetometer	not addressed	n/a	2490 points	n/a	Data reviewed in TM 2	n/a	
	EM Survey	not addressed	n/a	2490 points	n/a	Data reviewed in TM 2	n/a	
	Soil Gas Survey	Over Old landfill	not addressed	Not Determined	28-33	TM 4 - 343 samples 10 % resampled for a maximum of 27	28-33	
	Surficial Soil	not addressed	not addressed	2/Rad Anomaly Random in landfill	**Random** 1-4, 8, 11 12x, 21 **Rad Anomalies** 1 - 4	TM 3 Min. 11 Loc.- Hot Spots 3 Loc.- East of Landfill 51 Loc.- over landfill	 1-7 1-8,8x,11-16 21 1-4,6-8, 11-17,21	A total of 67 samples were collected along with 5 duplicates to total 72
	Soil Cores	1 per/50 SGS pts.	not addressed	1/15 SG Sam.	not addressed	TM 5 Deleted program	n/a	
	Soil Borings	If positive soil gas results, then drill soil borings at locations which may have ground water.	1-4,8,9 11,14	3/SGS plume 1 at each of 2 ponds 6-Disturbed Area	**2 FT Grab** 9 **6 Ft** 1-4,9,11,12x **SG Borings** 9,12x	In Monitoring Well File	n/a	TM 8 Cancelled/Replaced by two letters which specify number and location of samples
	Monitoring Wells	If GW is found in Soil Borings	1-4,6,7 8x,10,11x,	3 wells	**Water** 1,2,2*,3,3*,4 4*,6*,7*,8,8x 9,11,36,38	In Monitoring Well File	not addressed see Work Plan	TM 8 Cancelled/Replaced by two letters which specify number and location of samples
	Alluvial Wells	3 Wells	2,2*,3,3* 6*,7,8x,10 11x,37	4 wells	**Water** 1,2,2*,3 3*,4,4* 6*,7*,8 8x,9,11 36,38	6 wells	not addressed see Work Plan	
	Pipe Outfall	If H2O, Then sample Quarterly	2,2*,3,3* 6*,7,8x,10 11x,37	1 Sample from both pipes	1-4,1*-4* 6*,7*,8,8x,9,10 12x,36,38	not addressed	n/a	
	Cone Penetrometer Testing (CPT)	not addressed	n/a	To Be Determined in TM 6	n/a	TM 6 - 22 CPT points 15 well points GW Samples taken from well points	**Ground Water** 1-7,10 12,18-27	BAT® Sampling replaced by Well Points

Note: See Page 6 for Key to Codes for Analytes

Table 2.1-1: Matrix of OU5 RFI/RI FSP Requirements from IAG, Work Plan, and Technical Memoranda

IHSS	ACTIVITY	IAG		WORK PLAN		MODIFIED BY TM		Comments
		TASK	Analytes	TASK	Analytes	TASK	ANALYTES	
133.1-133.6	Rad Survey	FIDLER	n/a	HPGE Survey	n/a	reviewed in TM 2 FIDLER Survey over hot spots	n/a	
Ash Pits, Incinerator and Concrete Wash Pad	Soil Borings	Does not specify	1,2	To Be Determined	1-4,8	TM 7 - 46 Total -28 Locations with exploratory BH's	1-4,8	Work Plan-100% HPGE coverage17 Exploratory Boreholes and 1 HPGe Anomaly completed Field Parameters: pH s.c., temp., DO., Barometric Pressure
	Groundwater Samples from Soil Borings if Water is encountered	not addressed	n/a	not addressed	n/a	TM 7 - Maximum of 10 Samples	1-4,8	
	Magnetometer	not addressed	n/a	4864 points	n/a	Reviewed in TM 2	n/a	
	EM Survey	not addressed	n/a	4864 points	n/a	Reviewed in TM 2	n/a	
	Surficial Soil	At hot spots	1,2	To Be Determined	**Random** 1-4,8,21 **Rad Anomalies** 1-4	TM 4 - 20 samples 8 previous samples for environmental evaluation	1-4,8,21	
	Alluvial GW Wells	3 Locations	2,2*,3,3 *6*,7,8x 10,11x	3 Locations	1-4,1*-4* 6*,7*,8,9,11,	TM 9 - 4 Locations	**Soil Samples** 1-4,8 **GW Samples** 1,2,8	**Field Measurements** pH Specific Conductance Temperature Dissolved Oxygen Barometric Pressure

Note: See Page 6 for Key to Codes for Analytes

Table 2.1-1: Matrix of OU5 RFI/RI FSP Requirements from IAG, Work Plan, and Technical Memoranda

IHSS	ACTIVITY	IAG		WORK PLAN		MODIFIED BY TM		Comments
		TASK	Analytes	TASK	Analytes	TASK	ANALYTES	
142.10,11 C-1 and C-2 Ponds	Pond Surface Water	5 Locations at each pond	1-7,1*-4* 6*,7*,8x 8x*,10,11x 38	5 Locations at each pond	1-4,1*-4* 5,6*,7*,8,8* 9,11,38	TM 1 - C-1 Field Parameters. No field work in Pond C-2	**Field Parameters** Temperature Specific Conductance pH Dissolved Oxygen	NPDES data used for characterization of both ponds
	Pond Sediment	5 Locations	1-7,8x 10,11,38	Locations	1-5,8,9 11,12x,38	TM 1 - 3 Locations in each Pond	5-8,9,11,37,38 1-4,39	These analyses only apply to the top 6" Note: the maximum amount of sediment sampled was less than 6"
	GW Wells	4 Wells	1-4,1*-4*,5,6 6*,7,7*,8x 8x*,10,11x,38	Min. of 4	1-5,1*-4* 6*,7*,8,8*,9 11,37,38	not addressed	n/a	

Note: See Page 6 for Key to Codes for Analytes

Table 2.1-1: Matrix of OU5 RFI/RI FSP Requirements from IAG, Work Plan, and Technical Memoranda

IHSS	ACTIVITY	IAG		WORK PLAN		MODIFIED BY TM		Comments
		TASK	Analytes	TASK	Analytes	TASK	ANALYTES	
209 Surface Disturbances	Rad Survey	not addressed	n/a	FIDLER	n/a	not addressed	n/a	
	Sediment Sample in former ponds	not addressed	n/a	1 Location in each pond	1-4,8,9 11,12x	not addressed	n/a	
	SW if Present in former ponds	not addressed	n/a	1 Location in each pond	1-4,8,9,11	not addressed	n/a	
	Surface Soil	not addressed	n/a	19 Locations	1-4,8,9,11,21	TM 10 - 19 Locations	2-4,8,11,12x 13-15,17,21	
	Boreholes	not addressed	n/a	19 Boreholes	**2 FT Intervals** 9 **6 FT Intervals** 1-4,8,9,11,21	TM 10 - 4 Boreholes	**2 Ft Intervals** 9 **6 Ft Intervals** 1-4,8,11	
	Soil in Small Depressions	not addressed	n/a	not determined	1-4,8,9 11,12x,21	TM 10	n/a	Include with Surface Soil Sampling in TM 10

Note: See Page 6 for Key to Codes for Analytes

Table 2.1-1: Matrix of OU5 RFI/RI FSP Requirements from IAG, Work Plan, and Technical Memoranda

Stream Sampling Program

IHSS	ACTIVITY	IAG		WORK PLAN		MODIFIED BY TM		
		TASK	Analytes	TASK	Analytes	TASK	ANALYTES	Comments
115	Stream SW	not determined	2,2*,3,3* 6*,7.8x,10 11x,37	6 Locations	1-4,1*-4*,6* 7*,8,8x,9,11,12x 36	see TM 1 below	n/a	TM 1 specifies 4 synoptic sampling events, 2 base flow and 2 storm events.
	Stream Sed	not determined	2,3,10,11x 8x,6,7,37	4 Locations	1-4,8,9,11,12x	see TM 1 below	n/a	
133	Seds Downstream of Ash Pits	not addressed	n/a		1-5,8,21,38	see TM 1 below	n/a	
142	Stream Sediments	28 Locations	1-7,8x,10 11x,38	12 Locations 18 from Site Wide Program	1-5,8,9 11,21,38	see TM 1 below	n/a	
TM 1 for all OU 5	Stream Surface Water	n/a	n/a	n/a	n/a	14 Locations per TM 1 9 for Storm Event	1-4,2*-4*,6*,7* 8,8x,9,11,12x,36 9,11,12x 39	These Analytes for Base Flow Events Only SW040,SW041 SW50193,SW50293 SW033,SW034 SW026,SW027
	Stream Sediments	n/a	n/a	n/a	n/a	9 Locations per TM 2	1-4,8,21,38 5 39	SW027, SW024 Only Only Analyte at SED505 Collected at SED501, and SED 506

Note: See Page 6 for Key to Codes for Analytes

Table 2.1-1: Matrix of OU5 RFI/RI FSP Requirements from IAG, Work Plan, and Technical Memoranda

ANALYTE	Code	ANALYTE	Code
Gross A/B	1	COD	22
Filtered Gross A/B	1*	Orthophosphate	23
U 233/234,235,238	2	NO3/NO2 as N	24
Dissolved U 233/234,235,238	2*	Ra 226/228	25
Plutonium 239/240	3	TDS,Cl,F,SO4,CO3,HCO3	26
Dissolved Plutonium 239/240	3*	Cyanide	27
Americium 241	4	1,1,1 Trichloroethane (TCA)	28
Dissolved Americium 241	4*	Dichloromethane	29
Tritium	5	Benzene	30
Cesium 137	6	Carbon Tetrachloride (CCL4)	31
Dissolved Cesium 137	6*	Tetrachioroethene (PCE)	32
Strontium 89/90	7	Trichloroethene (TCE)	33
Dissolved Strontium 89/90	7*	Dissolved Anions TDS	36
TAL Metals	8	Chromium	37
Dissolved TAL Metals	8*	Nitrate	38
HSL Metals	8x	Micro/Acute Toxicity	39
Dissolved HSL Metals	8x*		
TCL Volatiles	9		
HSL Volatiles	10		
TCL Semivolatiles	11		
HSL Semivolatiles	11x		
TCL Pesticides - PCB's	12		
TCL Pesticides	12x		
Bulk Density	13		
Particle Size Analysis	14		
Specific Conductance	15		
Carbonate	16		
pH	17		
CLP Metals w/Cs,Li,Sr,Sn,Mo,Si	18		
BNA	19		
TSS	20		
TOC	21		

Table 2.3-1: Background Summary Statistics for Upper Flow System Geologic Materials

Metals

Analyte Name	Sample Size (N)	BUTL 1)	Max. Conc. 2)	Mean	Minimum	Maximum	Unit
Aluminum	98	39,105.66		12,752.03	279.00	102,000.00	MG/KG
Antimony	66	47.00	47.00	4.71	0.95	47.00	MG/KG
Arsenic	99	14.66		3.88	0.27	41.80	MG/KG
Barium	99	321.20		96.46	9.40	777.00	MG/KG
Beryllium	99	15.75		4.78	0.46	23.50	MG/KG
Cadmium	81	2.17		0.82	0.08	2.30	MG/KG
Calcium	81	44,733.41		6,951.09	580.00	157,000.00	MG/KG
Cesium	95	867.74		230.46	81.75	2,830.00	MG/KG
Chromium	99	76.30		19.61	4.10	176.00	MG/KG
Cobalt	99	32.60		7.50	1.90	93.90	MG/KG
Copper	99	42.43		12.57	1.10	123.00	MG/KG
Iron	99	45,421.42		14,531.98	1,300.00	132,000.00	MG/KG
Lead	99	27.29		10.87	2.60	39.80	MG/KG
Lithium	99	38.45		11.76	1.45	83.20	MG/KG
Magnesium	99	10,426.06		2,584.42	356.50	32,500.00	MG/KG
Manganese	99	1,014.41		217.64	37.00	3,330.00	MG/KG
Mercury	86	2.20		0.24	0.03	5.90	MG/KG
Molybdenum	99	67.60	67.60	8.93	1.00	67.60	MG/KG
Nickel	96	69.05		20.73	2.15	193.00	MG/KG
Potassium	98	7,002.88		1,311.57	186.50	18,700.00	MG/KG
Selenium	82	6.68		1.22	0.11	13.70	MG/KG
Silver	83	34.39		5.62	0.27	40.90	MG/KG
Sodium	99	3,680.00		300.66	63.00	3,680.00	MG/KG
Strontium	99	235.42		65.62	10.15	242.00	MG/KG
Thallium	75	4.10	4.10	0.52	0.09	4.10	MG/KG
Tin	92	323.37		61.75	10.10	441.00	MG/KG
Vanadium	99	97.89		31.49	4.22	283.00	MG/KG
Zinc	98	155.97		36.86	0.26	486.00	MG/KG

Radionuclides

Analyte Name	Sample Size (N)	BUTL 1)	Max. Conc. 2)	Mean	Minimum	Maximum	Unit
Americium-241	28	0.02		0.00	-0.02	0.01	PCI/G
Cesium-137	99	0.11		0.01	0.00	0.20	PCI/G
Gross Alpha	99	49.48		24.91	5.00	48.00	PCI/G
Gross Beta	99	40.75		24.72	6.00	44.00	PCI/G
Plutonium-239/240	99	0.02		0.00	-0.01	0.03	PCI/G
Radium-226	83	1.45		0.75	0.50	1.30	PCI/G
Radium-228	83	2.37		1.40	0.50	2.20	PCI/G
Strontium-89/90	99	0.98		0.03	-0.60	1.20	PCI/G
Tritium	99	477.09		141.72	-150.00	440.00	PCI/L
Uranium-233/234	99	3.25		0.78	0.20	8.90	PCI/G
Uranium-235	99	0.14		0.02	0.00	0.20	PCI/G
Uranium-238	99	1.73		0.73	0.20	3.20	PCI/G
Uranium-Total	99	3.55		1.46	0.50	6.70	PCI/G

Water Quality Parameters

Analyte Name	Sample Size (N)	BUTL 1)	Max. Conc. 2)	Mean	Minimum	Maximum	Unit
Nitrate/Nitrite	98	7.10	7.10	0.94	0.50	7.10	MG/KG
Sulfide	97	9.88		2.22	1.00	21.00	MG/KG
pH	88	9.61		8.00	6.10	9.10	PH

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.3-2: Background Summary Statistics for Surface Soils

Metals

Analyte Name	Sample Size (N)	BUTL	Max. Conc. 1)	Mean	Minimum	Maximum	Unit
Aluminum	20	25,758.00		13,257.70	7,715.00	21,800.00	MG/KG
Arsenic	20	12.78		5.79	2.10	8.50	MG/KG
Barium	20	492.59		199.70	120.00	470.00	MG/KG
Beryllium	20	5.98		1.55	0.45	2.50	MG/KG
Cadmium	19	4.79		1.35	0.50	2.50	MG/KG
Calcium	20	15,913.70		5,413.00	2,260.00	2,938.38	MG/KG
Cesium	20	593.60		116.24	2.10	250.00	MG/KG
Chromium	20	28.01		15.21	9.20	22.00	MG/KG
Cobalt	20	19.09		7.80	4.40	24.00	MG/KG
Copper	20	30.03		13.45	7.70	23.10	MG/KG
Iron	20	29,288.80		15,553.50	10,400.00	24,900.00	MG/KG
Lead	20	63.12		37.62	26.65	51.00	MG/KG
Lithium	20	21.95		11.23	7.10	17.70	MG/KG
Magnesium	20	7,629.15		2,977.00	1,440.00	6,380.00	MG/KG
Manganese	20	1,257.80		432.85	188.50	2,220.00	MG/KG
Mercury	18	2.70	2.70	2.70	2.70	2.70	MG/KG
Molybdenum	20	20.00	20.00	14.64	2.70	20.00	MG/KG
Nickel	20	26.99		12.74	7.80	18.70	MG/KG
Potassium	20	5,980.20		3,080.50	1,950.00	5,235.00	MG/KG
Selenium	20	1.38		0.60	0.28	1.00	MG/KG
Silicon	20	7,318.88		720.59	54.80	1,845.00	MG/KG
Silver	20	5.00	5.00	2.80	1.00	5.00	MG/KG
Sodium	20	1,510.76		290.58	56.90	500.00	MG/KG
Strontium	20	96.88		37.97	20.90	109.00	MG/KG
Thallium	20	2.02		0.80	0.28	1.00	MG/KG
Tin	20	81.21		36.23	20.00	58.50	MG/KG
Vanadium	20	60.62		31.97	20.95	46.60	MG/KG
Zinc	20	97.20		57.26	41.40	92.25	MG/KG

Radionuclides

Analyte Name	Sample Size (N)	BUTL	Max. Conc. 1)	Mean	Minimum	Maximum	Unit
Americium-241	16	0.06		0.02	-0.00	0.04	PCI/G
Cesium-137	12	3.68		1.41	0.71	2.50	PCI/G
Gross Alpha	9	42.22		20.83	16.00	28.00	PCI/G
Gross Beta	9	55.67		30.83	24.00	40.00	PCI/G
Plutonium-239/240	20	0.13		0.05	0.03	0.10	PCI/G
Radium-226	10	1.60		0.95	0.75	1.10	PCI/G
Radium-228	10	4.87		2.18	1.30	2.90	PCI/G
Strontium-89/90	9	2.22		0.62	0.10	1.00	PCI/G
Uranium-233/234	18	1.76		1.14	0.91	1.50	PCI/G
Uranium-235	18	0.19		0.05	0.01	0.12	PCI/G
Uranium-238	18	1.90		1.17	0.89	1.52	PCI/G

1) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.3-3: Background Summary Statistics for Upper Flow System Groundwater

Metals

Analyte Name	Sample Size (N)	BUTL 1)	Max. Conc. 2)	Mean	Minimum	Maximum	Unit
Aluminum, Dissolved	246	262.91		59.52	2.50	1,036.00	UG/L
Aluminum, Total	147	12,642.33		2,742.80	22.60	19,950.00	UG/L
Antimony, Dissolved	248	43.20		17.34	3.00	54.10	UG/L
Antimony, Total	141	49.14		19.19	3.60	86.60	UG/L
Arsenic, Dissolved	220	15.00	15.00	1.63	0.40	15.00	UG/L
Arsenic, Total	138	5.93		1.95	0.35	5.00	UG/L
Barium, Dissolved	256	163.94		83.42	14.75	203.00	UG/L
Barium, Total	148	208.14		102.44	25.90	317.00	UG/L
Beryllium, Dissolved	212	4.00	4.00	1.01	0.15	4.00	UG/L
Beryllium, Total	148	4.80	4.80	1.07	0.40	4.80	UG/L
Cadmium, Dissolved	240	4.66		1.73	0.50	8.60	UG/L
Cadmium, Total	148	11.10	11.10	1.64	0.50	11.10	UG/L
Calcium, Dissolved	256	131,288.91		55,414.55	15,150.00	184,000.00	UG/L
Calcium, Total	149	128,816.15		55,030.23	15,950.00	186,000.00	UG/L
Cesium, Dissolved	211	867.87		202.20	2.00	2,500.00	UG/L
Cesium, Total	142	617.60		154.42	2.00	500.00	UG/L
Chromium, Dissolved	250	13.69		4.84	1.00	23.20	UG/L
Chromium, Total	143	22.58		7.01	1.00	31.65	UG/L
Cobalt, Dissolved	231	29.00	29.00	6.60	1.00	29.00	UG/L
Cobalt, Total	148	39.40	39.40	7.64	1.00	39.40	UG/L
Copper, Dissolved	248	15.32		5.01	0.50	20.90	UG/L
Copper, Total	148	39.12		10.67	1.00	105.00	UG/L
Cyanide, Dissolved	3	97.09		5.83	2.50	10.00	UG/L
Cyanide, Total	155	5.55	5.55	1.20	0.75	5.55	UG/L
Iron, Dissolved	255	320.57		56.26	1.00	1,106.50	UG/L
Iron, Total	147	14,654.53		3,017.34	6.50	27,100.00	UG/L
Lead, Dissolved	251	12.57		1.59	0.20	64.00	UG/L
Lead, Total	140	11.75		3.26	0.50	25.00	UG/L
Lithium, Dissolved	250	160.47		33.95	0.50	250.00	UG/L
Lithium, Total	149	147.37		33.75	1.10	266.00	UG/L
Magnesium, Dissolved	253	29,399.19		10,038.28	2,120.00	46,300.00	UG/L
Magnesium, Total	149	28,854.11		10,315.64	2,230.25	47,900.00	UG/L
Manganese, Dissolved	255	184.57		27.47	0.50	440.00	UG/L
Manganese, Total	148	331.64		79.59	0.50	584.00	UG/L
Mercury, Dissolved	207	0.69	0.69	0.11	0.05	0.69	UG/L
Mercury, Total	148	0.22		0.12	0.10	0.27	UG/L
Molybdenum, Dissolved	241	98.73		19.64	1.00	114.00	UG/L
Molybdenum, Total	150	116.04		24.09	1.00	100.00	UG/L
Nickel, Dissolved	236	23.73		7.01	1.00	35.80	UG/L
Nickel, Total	145	32.68		10.58	1.00	71.60	UG/L
Phosphorus, Dissolved	8	471.74		167.00	80.00	231.00	UG/L
Potassium, Dissolved	252	3,862.30		1,371.50	160.00	8,110.00	UG/L
Potassium, Total	150	4,472.65		1,731.21	243.00	8,370.00	UG/L
Selenium, Dissolved	219	50.02		5.58	0.50	173.00	UG/L
Selenium, Total	144	47.99		4.57	0.50	203.00	UG/L
Silicon, Total	82	48,399.65		15,564.97	4,399.00	51,650.00	UG/L
Silver, Dissolved	235	7.79		2.84	1.00	11.80	UG/L
Silver, Total	147	10.00	10.00	2.35	1.00	10.00	UG/L
Sodium, Dissolved	254	133,758.65		32,012.98	2,500.00	252,000.00	UG/L
Sodium, Total	149	123,327.78		30,081.85	2,500.00	194,000.00	UG/L
Strontium, Dissolved	252	1,030.95		323.60	50.00	1,910.00	UG/L
Strontium, Total	146	944.25		312.61	58.10	1,770.00	UG/L
Thallium, Dissolved	212	5.44		1.64	0.30	5.00	UG/L
Thallium, Total	146	5.77		1.67	0.45	5.00	UG/L
Tin, Dissolved	235	117.96		30.96	2.00	340.00	UG/L
Tin, Total	149	116.20		33.88	4.70	100.00	UG/L
Vanadium, Dissolved	249	28.26		7.92	0.60	50.00	UG/L
Vanadium, Total	148	46.64		13.81	1.00	123.00	UG/L
Zinc, Dissolved	256	55.66		14.03	1.00	137.00	UG/L
Zinc, Total	149	153.21		37.16	4.20	498.00	UG/L

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.3-3 (cont.): Background Summary Statistics for Upper Flow System Groundwater

Radionuclides

Analyte Name	Sample Size (N)	BUTL 1)	Max. Conc. 2)	Mean	Minimum	Maximum	Unit
Amercium-241, Total	183	0.03		0.01	-0.01	0.10	PCI/L
Americium-241, Dissolved	2	2.11		0.01	0.00	0.02	PCI/L
Cesium-137, Dissolved	38	2.14		0.42	-0.19	2.60	PCI/L
Cesium-137, Total	156	1.00		0.12	-0.59	1.16	PCI/L
Gross Alpha, Dissolved	213	93.86		8.35	-0.65	312.70	PCI/L
Gross Alpha, Total	23	390.58		43.50	0.35	362.00	PCI/L
Gross Beta, Dissolved	196	37.25		4.89	-1.50	135.90	PCI/L
Gross Beta, Total	23	221.31		24.95	0.20	220.00	PCI/L
Plutonium-238, Total	15	0.03		0.00	0.00	0.03	PCI/L
Plutonium-239/240, Dissolved	1	0.01	0.01	0.01	0.01	0.01	PCI/L
Plutonium-239/240, Total	194	0.06		0.00	-0.01	0.22	PCI/L
Radium-226, Dissolved	36	0.63		0.26	0.06	0.53	PCI/L
Radium-226, Total	6	1.29		0.36	0.18	0.52	PCI/L
Radium-228, Dissolved	6	5.94		2.12	1.70	3.00	PCI/L
Strontium-89/90, Dissolved	180	1.05		0.34	-0.40	1.80	PCI/L
Strontium-89/90, Total	32	1.15		0.22	-0.29	1.12	PCI/L
Tritium, Dissolved	164	578.79		101.70	-223.00	955.45	PCI/L
Tritium, Total	83	13,539.22		624.85	-240.00	1,385.00	PCI/L
Uranium-233/234, Dissolved	205	74.22		6.91	-0.02	199.50	PCI/L
Uranium-233/234, Total	35	144.83		15.62	0.00	164.00	PCI/L
Uranium-235, Dissolved	207	1.88		0.20	-0.04	4.80	PCI/L
Uranium-235, Total	35	5.23		0.62	-0.02	6.29	PCI/L
Uranium-238, Dissolved	176	51.60		4.83	-0.04	135.60	PCI/L
Uranium-238, Total	22	114.17		10.84	0.00	108.00	PCI/L

Water Quality Parameters

Analyte Name	Sample Size (N)	BUTL 1)	Max. Conc. 2)	Mean	Minimum	Maximum	Unit
Alkalinity	3	3,947.77		156.90	60.50	340.00	MG/L
Bicarbonate	311	577.31		233.81	46.94	755.90	MG/L
Carbonate	300	32.38	32.38	1.82	0.00	32.38	MG/L
Chloride	257	42.37		12.24	1.20	118.00	MG/L
Cyanide	66	20.00	20.00	7.94	2.00	20.00	UG/L
Fluoride	300	1.71		0.61	0.10	2.90	MG/L
Nitrate/Nitrite	305	5.26		1.05	0.01	12.00	MG/L
Nitrite	54	0.15		0.03	0.01	0.20	MG/L
Orthophosphate	191	0.06		0.01	0.00	0.20	MG/L
Phosphorus	56	0.17		0.04	0.01	0.17	MG/L
Silica	274	32.90		14.08	3.80	57.00	MG/L
Sodium Nitrite	1	0.02	0.02	0.02	0.02	0.02	MG/L
Sulfate	278	493.22		86.37	2.90	1,200.00	MG/L
Total Dissolved Solids	310	1,082.48		355.49	66.00	1,580.00	MG/L
Total Solids	4	479.75		24.02	2.50	79.10	MG/L
Total Suspended Solids	301	1,133.72		133.40	2.00	6,400.00	MG/L
pH	3	18.20		7.17	6.90	7.70	pH

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.3-4: Background Summary Statistics for Stream Water

Metals

Analyte Name	Sample Size (N)	BUTL 1)	Max. Conc. 2)	Mean	Minimum	Maximum	Unit
Aluminum, Dissolved	134	475.18		89.90	4.50	1,050.00	UG/L
Aluminum, Total	139	3,892.76		747.63	9.35	6,560.00	UG/L
Antimony, Dissolved	92	59.20		18.01	3.75	104.00	UG/L
Antimony, Total	119	54.80	54.80	15.10	3.50	54.80	UG/L
Arsenic, Dissolved	94	5.00	5.00	1.32	0.35	5.00	UG/L
Arsenic, Total	110	5.84		1.73	0.25	11.50	UG/L
Barium, Dissolved	145	127.74		45.17	12.25	391.00	UG/L
Barium, Total	131	138.11		58.84	19.15	306.00	UG/L
Beryllium, Dissolved	90	17.00	17.00	1.08	0.10	17.00	UG/L
Beryllium, Total	115	2.50	2.50	0.78	0.10	2.50	UG/L
Cadmium, Dissolved	78	3.50	3.50	1.80	0.70	3.50	UG/L
Cadmium, Total	108	5.00	5.00	1.89	0.70	5.00	UG/L
Calcium, Dissolved	154	50,358.44		23,621.75	5,425.00	79,300.00	UG/L
Calcium, Total	153	49,464.66		23,601.21	5,505.75	74,600.00	UG/L
Cesium, Dissolved	98	2,500.00	2,500.00	384.06	1.00	2,500.00	UG/L
Cesium, Total	120	1,250.00	1,250.00	256.15	1.00	1,250.00	UG/L
Chromium, Dissolved	90	14.80	14.80	3.15	1.00	14.80	UG/L
Chromium, Total	120	18.90	18.90	3.88	1.00	18.90	UG/L
Cobalt, Dissolved	87	25.00	25.00	4.87	1.00	25.00	UG/L
Cobalt, Total	116	25.00	25.00	5.71	1.00	25.00	UG/L
Copper, Dissolved	125	17.48		5.90	1.00	28.00	UG/L
Copper, Total	121	16.95		5.59	1.00	25.60	UG/L
Iron, Dissolved	153	560.62		144.92	3.00	1,060.00	UG/L
Iron, Total	157	7,926.75		1,247.08	4.85	26,300.00	UG/L
Lead, Dissolved	113	5.14		1.33	0.20	13.10	UG/L
Lead, Total	131	7.36		1.88	0.40	21.00	UG/L
Lithium, Dissolved	119	63.66		15.71	0.50	50.50	UG/L
Lithium, Total	126	52.35		11.77	1.00	50.00	UG/L
Magnesium, Dissolved	150	9,800.47		4,735.82	1,345.00	17,800.00	UG/L
Magnesium, Total	146	9,812.65		4,901.94	1,360.00	16,600.00	UG/L
Manganese, Dissolved	149	139.22		28.02	0.47	353.00	UG/L
Manganese, Total	151	885.29		84.76	0.65	4,060.00	UG/L
Mercury, Dissolved	83	0.44	0.44	0.12	0.05	0.44	UG/L
Mercury, Total	122	1.40	1.40	0.13	0.05	1.40	UG/L
Molybdenum, Dissolved	93	250.00	250.00	32.82	1.00	250.00	UG/L
Molybdenum, Total	125	50.00	50.00	12.65	1.00	50.00	UG/L
Nickel, Dissolved	86	21.80	21.80	7.45	1.50	21.80	UG/L
Nickel, Total	120	20.00	20.00	7.37	1.50	20.00	UG/L
Potassium, Dissolved	126	3,585.92		1,427.16	195.00	6,800.00	UG/L
Potassium, Total	128	4,167.09		1,669.97	190.00	6,700.00	UG/L
Selenium, Dissolved	85	13.26		2.24	0.50	20.00	UG/L
Selenium, Total	120	6.33		1.55	0.40	20.00	UG/L
Silicon, Total	67	16,346.19		6,076.23	690.00	15,200.00	UG/L
Silver, Dissolved	99	15.00	15.00	2.76	1.00	15.00	UG/L
Silver, Total	116	7.80	7.80	2.59	1.00	7.80	UG/L
Sodium, Dissolved	153	34,096.80		16,603.04	3,640.00	44,700.00	UG/L
Sodium, Total	155	33,817.24		16,060.41	1,850.00	45,400.00	UG/L
Strontium, Dissolved	139	972.43		241.81	33.45	1,000.00	UG/L
Strontium, Total	135	590.13		171.63	32.95	1,000.00	UG/L
Thallium, Dissolved	98	15.00	15.00	1.82	0.45	15.00	UG/L
Thallium, Total	124	20.00	20.00	1.80	0.30	20.00	UG/L
Tin, Dissolved	99	83.05		28.52	4.65	136.00	UG/L
Tin, Total	118	67.07		20.18	3.50	136.00	UG/L
Vanadium, Dissolved	107	25.00	25.00	4.19	1.00	25.00	UG/L
Vanadium, Total	120	28.76		6.97	1.00	60.00	UG/L
Zinc, Dissolved	139	55.86		13.59	0.85	111.50	UG/L
Zinc, Total	151	175.64		31.91	0.85	480.00	UG/L

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.3-4 (cont.): Background Summary Statistics for Stream Water

Radionuclides

Analyte Name	Sample Size (N)	BUTL 1)	Max. Conc. 2)	Mean	Minimum	Maximum	Unit
Americium-241, Total	106	0.02		0.00	-0.02	0.04	PCI/L
Americium-241, Dissolved	34	0.50		0.07	-0.01	0.50	PCI/L
Cesium-134, Dissolved	3	4.67		2.27	2.17	2.37	PCI/L
Cesium-134, Total	8	9.04		1.53	1.03	4.73	PCI/L
Cesium-137, Dissolved	10	6.99		0.82	-0.44	2.40	PCI/L
Cesium-137, Total	93	1.63		0.23	-0.56	4.20	PCI/L
Gross Alpha, Dissolved	60	28.71		0.69	-1.38	5.00	PCI/L
Gross Alpha, Total	85	28.06		1.51	-2.00	13.00	PCI/L
Gross Beta, Dissolved	61	25.30		4.69	-0.68	41.82	PCI/L
Gross Beta, Total	82	30.35		4.55	-0.40	36.00	PCI/L
Gross Gamma, Dissolved	24	1.63		0.70	-0.12	1.00	PCI/L
Plutonium-236, Dissolved	4	0.07		0.00	0.00	0.01	PCI/L
Plutonium-236, Total	12	0.01		0.00	-0.01	0.00	PCI/L
Plutonium-238, Dissolved	4	0.07		0.01	0.00	0.01	PCI/L
Plutonium-238, Total	12	0.03		0.00	-0.02	0.01	PCI/L
Plutonium-239/240, Dissolved	36	0.79		0.12	-0.12	0.90	PCI/L
Plutonium-239/240, Total	105	0.02		0.00	-0.02	0.05	PCI/L
Radium-226, Dissolved	3	5.23		0.19	-0.05	0.34	PCI/L
Radium-226, Total	4	16.56		1.07	-0.10	2.30	PCI/L
Radium-228, Dissolved	2	92.93		1.05	0.70	1.40	PCI/L
Strontium-89/90, Dissolved	87	2.42		0.73	-0.50	3.00	PCI/L
Strontium-89/90, Total	75	4.88		0.92	-0.20	6.95	PCI/L
Tritium, Dissolved	54	1,498.07		111.86	-41.80	686.10	PCI/L
Tritium, Total	73	711.94		75.71	-800.00	751.00	PCI/L
Uranium-233/234, Dissolved	55	14.20		0.36	-0.02	1.80	PCI/L
Uranium-233/234, Total	79	2.16		0.49	-0.01	3.21	PCI/L
Uranium-235, Dissolved	56	0.78		0.14	-0.02	0.90	PCI/L
Uranium-235, Total	75	0.28		0.05	-0.03	0.38	PCI/L
Uranium-238, Dissolved	55	10.93		0.28	0.00	1.70	PCI/L
Uranium-238, Total	55	1.73		0.36	0.00	1.82	PCI/L
Uranium-Total, Dissolved	6	4.27		0.72	0.10	1.40	PCI/L
Uranium-Total, Total	17	2.69		0.59	0.10	2.20	PCI/L

Water Quality Parameters

Analyte Name	Sample Size (N)	BUTL 1)	Max. Conc. 2)	Mean	Minimum	Maximum	Unit
Bicarbonate	154	191.32		97.57	15.73	243.84	MG/L
CBDO5	10	27.49		7.63	3.80	14.50	MG/L
Carbonate	154	7.51		3.00	0.00	15.29	MG/L
Chloride	151	53.20		16.83	0.89	88.20	MG/L
Cyanide	129	14,386.67		2,221.93	1.25	20,000.00	UG/L
Dissolved Organic Carbon	35	17.00		6.10	2.00	16.00	MG/L
Fluoride	100	0.59		0.34	0.05	0.72	MG/L
Hydrogen Sulfide	3	0.50	0.50	0.50	0.50	0.50	MG/L
Nitrate/Nitrite	153	1.35		0.33	0.01	2.15	MG/L
Nitrite	85	0.06		0.01	0.01	0.10	MG/L
Oil and Grease	105	12.78		4.02	0.10	20.40	MG/L
Orthophosphate	95	0.58	0.58	0.03	0.01	0.58	MG/L
Phosphorus	102	0.17		0.04	0.01	0.42	MG/L
Silica	95	28.06		11.13	0.20	28.67	MG/L
Sodium Nitrite	17	0.05	0.05	0.03	0.03	0.05	MG/L
Sulfate	151	37.83		18.78	2.50	48.00	MG/L
Sulfide	73	4.00	4.00	0.74	0.50	4.00	MG/L
Total Dissolved Solids	151	302.28		170.12	58.00	486.00	MG/L
Total Organic Carbon	49	22.05		7.47	2.78	25.00	MG/L
Total Suspended Solids	159	125.53		18.88	1.00	400.00	MG/L
pH	51	9.32		7.34	3.75	8.60	PH

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.3-5: Background Summary Statistics for Stream Sediments

Metals

Analyte Name	Sample Size (N)	BUTL 1)	Max. Conc. 2)	Mean	Minimum	Maximum	Unit
Aluminum	59	21,387.27		5,887.61	549.00	25,200.00	MG/KG
Antimony	52	17.68		4.55	0.80	18.75	MG/KG
Arsenic	59	10.13		2.24	0.20	17.30	MG/KG
Barium	57	253.82		74.47	6.50	244.00	MG/KG
Beryllium	57	11.65		0.93	0.03	26.00	MG/KG
Cadmium	51	2.55		0.72	0.13	3.10	MG/KG
Calcium	59	18,446.12		3,554.57	93.50	17,100.00	MG/KG
Cesium	56	442.39		101.77	0.52	458.00	MG/KG
Chromium	59	31.88		8.25	0.48	29.70	MG/KG
Cobalt	59	16.43		5.16	0.29	16.65	MG/KG
Copper	59	36.78		10.81	0.31	36.70	MG/KG
Iron	59	28,612.98		8,852.63	1,040.00	31,400.00	MG/KG
Lead	59	138.09		22.02	2.10	244.00	MG/KG
Lithium	57	41.01		10.01	1.15	45.80	MG/KG
Magnesium	59	5,358.56		1,404.18	98.50	5,850.00	MG/KG
Manganese	59	907.35		229.52	9.00	1,280.00	MG/KG
Mercury	49	0.46		0.12	0.01	0.50	MG/KG
Molybdenum	58	31.75		5.48	0.33	45.80	MG/KG
Nickel	57	24.16		7.01	0.65	25.60	MG/KG
Potassium	58	3,159.74		812.50	57.00	3,770.00	MG/KG
Selenium	58	2.18		0.45	0.11	2.90	MG/KG
Silicon	19	1,741.79		331.53	46.70	1,450.00	MG/KG
Silver	54	3.11		0.86	0.20	3.40	MG/KG
Sodium	59	593.09		161.47	28.80	705.00	MG/KG
Strontium	58	291.42		45.62	2.80	421.00	MG/KG
Thallium	50	1.10		0.34	0.10	1.30	MG/KG
Tin	54	40.57		9.69	1.50	45.80	MG/KG
Vanadium	57	63.39		18.15	2.00	73.00	MG/KG
Zinc	58	139.04		44.44	6.10	155.00	MG/KG

Radionuclides

Analyte Name	Sample Size (N)	BUTL 1)	Max. Conc. 2)	Mean	Minimum	Maximum	Unit
Americium-241	35	1.77		0.07	-0.01	0.82	PCI/G
Cesium-137	35	1.54		0.26	-0.03	1.50	PCI/G
Gross Alpha	45	87.54		22.98	2.92	72.00	PCI/G
Gross Beta	43	66.83		35.35	19.46	59.00	PCI/G
Plutonium-238	5	0.00		0.00	0.00	0.00	PCI/G
Plutonium-239/240	42	5.62		0.17	0.00	2.36	PCI/G
Radium-226	21	2.22		0.85	0.43	1.80	PCI/G
Radium-228	20	4.55		1.70	0.52	3.45	PCI/G
Strontium-89/90	43	1.07		0.21	-0.60	1.17	PCI/G
Tritium	41	1,030.59		155.87	-23.20	380.00	PCI/L
Uranium-233/234	47	5.29		1.68	0.14	4.50	PCI/G
Uranium-235	49	0.21		0.06	0.00	0.19	PCI/G
Uranium-238	36	4.82		1.40	0.13	3.82	PCI/G
Uranium-Total	6	6.57		1.48	0.90	2.60	PCI/G

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.3-5 (cont.): Background Summary Statistics for Stream Sediments

Water Quality Parameters

Analyte Name	Sample Size (N)	BUTL 1)	Max. Conc. 2)	Mean	Minimum	Maximum	Unit
Alkalinity	28	19,839.86		1,970.44	0.33	25,000.00	MG/KG
Bicarbonate	4	18,993.76		1,041.25	93.00	3,180.00	MG/KG
Carbonate	4	26.50	26.50	19.87	0.00	26.50	MG/KG
Nitrate/Nitrite	52	57.19		7.76	0.30	76.00	MG/KG
Nitrite	12	1.21		0.34	0.10	0.80	MG/KG
Percent Solids	2	43.20	43.20	30.00	16.80	43.20	%
Total Alkalinity	6	63,997.31		4,470.00	320.00	21,000.00	MG/KG
Total Organic Carbon	1	24,000.00	24,000.00	24,000.00	24,000.00	24,000.00	MG/KG
pH	51	9.34		7.26	6.05	8.70	PH

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.3-6: Background Summary Statistics for Seep/Spring Water

Metals

Analyte Name	Sample Size (N)	BUTL 1)	Max. Conc. 2)	Mean	Minimum	Maximum	Unit
Aluminum, Dissolved	43	137.54		42.77	9.35	100.00	UG/L
Aluminum, Total	48	166,871.02		18,115.18	35.25	293,000.00	UG/L
Antimony, Dissolved	30	124.08		25.89	5.00	104.00	UG/L
Antimony, Total	34	411.91		46.68	3.75	643.00	UG/L
Arsenic, Dissolved	35	18.00	18.00	1.92	0.35	18.00	UG/L
Arsenic, Total	44	675.73		69.77	0.45	1,030.00	UG/L
Barium, Dissolved	47	205.69		71.95	19.05	211.00	UG/L
Barium, Total	44	6,252.00		913.39	23.00	7,070.00	UG/L
Beryllium, Dissolved	22	2.50	2.50	0.75	0.10	2.50	UG/L
Beryllium, Total	38	13.86		2.81	0.25	14.00	UG/L
Cadmium, Dissolved	27	2.50	2.50	1.54	0.80	2.50	UG/L
Cadmium, Total	33	67.29		9.08	0.80	68.40	UG/L
Calcium, Dissolved	50	159,064.39		50,222.00	18,500.00	216,000.00	UG/L
Calcium, Total	53	500,177.15		94,329.72	18,725.00	803,000.00	UG/L
Cesium, Dissolved	31	2,500.00	2,500.00	710.39	25.00	2,500.00	UG/L
Cesium, Total	33	1,936.79		419.98	25.00	2,530.00	UG/L
Chromium, Dissolved	28	14.80	14.80	3.11	1.00	14.80	UG/L
Chromium, Total	40	183.74		23.69	1.00	275.00	UG/L
Cobalt, Dissolved	31	25.00	25.00	4.17	1.10	25.00	UG/L
Cobalt, Total	35	346.73		43.39	1.00	489.00	UG/L
Copper, Dissolved	41	23.40		6.01	1.15	27.80	UG/L
Copper, Total	44	359.20		43.89	1.15	607.00	UG/L
Cyanide, Total	5	72.83		5.95	0.75	17.00	UG/L
Iron, Dissolved	49	14,808.10		1,927.00	0.55	16,700.00	UG/L
Iron, Total	51	1,811,483.71		175,074.71	48.75	3,220,000.00	UG/L
Lead, Dissolved	42	3.81		1.08	0.05	5.40	UG/L
Lead, Total	45	745.05		91.14	0.35	950.00	UG/L
Lithium, Dissolved	43	94.84		29.46	2.00	50.00	UG/L
Lithium, Total	35	118.02		29.43	3.50	140.00	UG/L
Magnesium, Dissolved	47	23,403.02		7,002.07	1,595.00	27,400.00	UG/L
Magnesium, Total	50	34,488.56		10,370.60	1,165.00	30,300.00	UG/L
Manganese, Dissolved	44	712.90		127.57	0.50	760.00	UG/L
Manganese, Total	51	17,658.34		1,798.04	2.10	27,700.00	UG/L
Mercury, Dissolved	22	1.16		0.18	0.05	1.30	UG/L
Mercury, Total	33	1.30	1.30	0.17	0.05	1.30	UG/L
Molybdenum, Dissolved	34	104.49		33.81	1.70	50.00	UG/L
Molybdenum, Total	33	165.51		33.46	1.50	203.00	UG/L
Nickel, Dissolved	24	20.00	20.00	6.28	1.50	20.00	UG/L
Nickel, Total	35	438.78		50.68	1.50	646.00	UG/L
Potassium, Dissolved	39	6,745.06		1,389.94	127.50	7,073.00	UG/L
Potassium, Total	41	13,071.50		3,386.23	379.50	13,500.00	UG/L
Selenium, Dissolved	28	19.00	19.00	2.25	0.40	19.00	UG/L
Selenium, Total	36	15.64		3.31	0.50	16.50	UG/L
Silicon, Total	11	23,029.71		8,408.18	2,290.00	12,700.00	UG/L
Silver, Dissolved	32	12.50	12.50	2.54	1.00	12.50	UG/L
Silver, Total	32	97.35		10.05	1.00	148.00	UG/L
Sodium, Dissolved	50	29,919.38		12,297.00	4,005.00	35,200.00	UG/L
Sodium, Total	53	27,834.09		12,005.80	280.00	26,100.00	UG/L
Strontium, Dissolved	45	1,749.29		481.40	64.50	1,000.00	UG/L
Strontium, Total	42	2,009.06		506.16	62.25	2,100.00	UG/L
Thallium, Dissolved	27	5.00	5.00	1.88	0.45	5.00	UG/L
Thallium, Total	39	5.00	5.00	2.41	0.45	5.00	UG/L
Tin, Dissolved	36	50.00	50.00	38.27	4.65	50.00	UG/L
Tin, Total	35	730.54		94.03	4.65	969.00	UG/L
Vanadium, Dissolved	38	25.00	25.00	5.43	1.00	25.00	UG/L
Vanadium, Total	41	1,002.88		117.09	1.00	1,650.00	UG/L
Zinc, Dissolved	46	82.33		15.68	0.85	105.00	UG/L
Zinc, Total	50	1,556.36		195.22	2.50	2,680.00	UG/L

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.3-6 (cont.): Background Summary Statistics for Seep/Spring Water

Radionuclides

Analyte Name	Sample Size (N)	BUTL 1)	Max. Conc. 2)	Mean	Minimum	Maximum	Unit
Amercium-241, Total	37	0.08		0.01	0.00	0.10	PCI/L
Americium-241, Dissolved	8	1.76		0.13	0.00	0.80	PCI/L
Cesium-137, Dissolved	3	4.71		-0.27	-0.50	-0.10	PCI/L
Cesium-137, Total	37	7.16		0.58	-0.30	12.00	PCI/L
Gross Alpha, Dissolved	13	26.09		2.78	-0.25	19.49	PCI/L
Gross Alpha, Total	36	340.13		42.52	-0.50	440.00	PCI/L
Gross Beta, Dissolved	14	49.69		5.97	-2.00	39.15	PCI/L
Gross Beta, Total	10	9.74		2.15	0.30	4.30	PCI/L
Gross Gamma, Dissolved	5	12.27		1.09	-0.13	3.20	PCI/L
Plutonium-239/240, Dissolved	8	1.02		0.10	0.00	0.40	PCI/L
Plutonium-239/240, Total	32	2.85		0.08	0.00	1.00	PCI/L
Radium-226, Dissolved	2	242.36		0.99	0.07	1.91	PCI/L
Radium-226, Total	12	49.88		7.72	0.20	30.00	PCI/L
Radium-228, Dissolved	1	0.70	0.70	0.70	0.70	0.70	PCI/L
Radium-228, Total	5	142.53		16.38	-1.10	36.00	PCI/L
Strontium-89/90, Dissolved	20	2.01		0.52	-0.30	1.00	PCI/L
Strontium-89/90, Total	32	1.61		0.32	-0.20	1.10	PCI/L
Tritium, Dissolved	12	1,637.06		226.36	82.59	560.00	PCI/L
Tritium, Total	30	4,277.76		140.35	-80.00	475.00	PCI/L
Uranium-233/234, Dissolved	13	4.19		0.91	0.00	2.60	PCI/L
Uranium-233/234, Total	33	4.99		0.64	-0.02	6.90	PCI/L
Uranium-235, Dissolved	12	0.72		0.12	-0.02	0.30	PCI/L
Uranium-235, Total	32	0.31		0.02	-0.20	0.19	PCI/L
Uranium-238, Dissolved	13	3.03		0.60	-0.10	1.70	PCI/L
Uranium-238, Total	28	4.89		0.64	-0.05	5.93	PCI/L
Uranium-Total, Dissolved	3	59.89		1.90	-0.10	4.60	PCI/L
Uranium-Total, Total	9	4.23		0.85	0.35	2.30	PCI/L

Water Quality Parameters

Analyte Name	Sample Size (N)	BUTL 1)	Max. Conc. 2)	Mean	Minimum	Maximum	Unit
Bicarbonate	60	2,135.32		321.64	69.98	4,100.00	MG/L
CBDO5	2	20.40	20.40	16.05	11.70	20.40	MG/L
Carbonate	55	20.16		44.96	0.00	24.22	MG/L
Chloride	53	66.35		12.52	2.00	130.00	MG/L
Cyanide	46	29.21		7.11	1.25	45.20	UG/L
Dissolved Organic Carbon	5	24.99		5.00	2.00	8.00	MG/L
Fluoride	18	1.60		0.55	0.20	0.96	MG/L
Nitrate/Nitrite	53	7.63		0.94	0.01	11.00	MG/L
Nitrite	16	0.06	0.06	0.01	0.01	0.06	MG/L
Oil and Grease	24	9.49		2.45	0.20	7.80	MG/L
Orthophosphate	18	0.07	0.07	0.02	0.01	0.07	MG/L
Phosphorus	18	3.54		0.35	0.03	3.40	MG/L
Silica	17	51.62		17.03	0.59	39.00	MG/L
Sodium Nitrite	3	0.03	0.03	0.03	0.03	0.03	MG/L
Sulfate	53	322.41		46.96	2.50	560.00	MG/L
Sulfide	10	1.00	1.00	0.55	0.50	1.00	MG/L
Total Dissolved Solids	53	813.81		263.87	18.00	1,100.00	MG/L
Total Organic Carbon	7	29.43		9.01	3.00	12.00	MG/L
Total Suspended Solids	54	27,293.31		2,712.31	2.00	46,000.00	MG/L
pH	35	8.64		7.22	6.00	7.90	PH

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.3-7: Background Summary Statistics for Seep/Spring Sediments

Metals

Analyte Name	Sample Size (N)	BUTL 1)	Max. Conc. 2)	Mean	Minimum	Maximum	Unit
Aluminum	20	29,553.14		10,354.30	4,760.00	21,600.00	MG/KG
Antimony	18	41.04		8.81	1.85	30.50	MG/KG
Arsenic	20	67.25		12.55	0.55	49.20	MG/KG
Barium	20	800.88		204.61	57.00	706.00	MG/KG
Beryllium	16	4.94		1.13	0.36	3.00	MG/KG
Cadmium	16	8.52		1.65	0.37	6.10	MG/KG
Calcium	20	80,940.62		19,407.50	3,900.00	61,000.00	MG/KG
Cesium	17	1,070.01		260.47	37.35	702.00	MG/KG
Chromium	18	31.87		10.98	4.20	22.50	MG/KG
Cobalt	19	29.81		8.47	0.65	21.90	MG/KG
Copper	18	61.04		18.74	6.80	43.20	MG/KG
Iron	18	110,559.63		20,763.89	2,250.00	85,200.00	MG/KG
Lead	18	126.03		36.37	8.10	80.30	MG/KG
Lithium	18	99.49		19.79	4.20	70.20	MG/KG
Magnesium	20	6,666.56		2,249.30	525.00	4,730.00	MG/KG
Manganese	19	1,327.33		261.63	34.90	974.00	MG/KG
Mercury	15	1.55		0.23	0.06	1.30	MG/KG
Molybdenum	19	92.59		15.77	1.50	70.20	MG/KG
Nickel	17	43.31		12.99	3.80	29.90	MG/KG
Potassium	18	3,493.61		1,050.72	222.00	2,350.00	MG/KG
Selenium	19	5.07		1.26	0.23	3.50	MG/KG
Silicon	10	12,440.63		1,698.70	313.00	7,100.00	MG/KG
Silver	15	10.49		2.15	0.48	6.80	MG/KG
Sodium	20	1,378.24		251.62	70.10	1,365.00	MG/KG
Strontium	20	466.32		113.70	15.90	343.00	MG/KG
Thallium	13	12.33		1.42	0.13	9.20	MG/KG
Tin	19	95.16		22.18	3.45	70.20	MG/KG
Vanadium	19	82.96		27.63	13.80	61.20	MG/KG
Zinc	20	143.00		56.13	17.30	112.00	MG/KG

Radionuclides

Analyte Name	Sample Size (N)	BUTL 1)	Max. Conc. 2)	Mean	Minimum	Maximum	Unit
Americium-241	13	1.46		0.05	0.00	0.54	PCI/G
Cesium-137	13	3.51		0.81	0.15	2.30	PCI/G
Gross Alpha	15	78.83		19.71	5.02	47.60	PCI/G
Gross Beta	14	45.76		23.73	16.37	32.50	PCI/G
Plutonium-238	3	0.01		0.00	0.00	0.00	PCI/G
Plutonium-239/240	15	7.68		0.21	0.00	2.30	PCI/G
Radium-226	9	1.97		0.71	0.24	1.10	PCI/G
Radium-228	9	2.88		1.18	0.71	1.60	PCI/G
Strontium-89/90	14	2.63		0.35	-0.20	1.73	PCI/G
Tritium	13	769.75		198.54	50.00	540.00	PCI/L
Uranium-233/234	16	2.39		0.82	0.06	1.43	PCI/G
Uranium-235	17	0.25		0.04	0.00	0.21	PCI/G
Uranium-238	14	2.52		0.73	0.07	1.61	PCI/G
Uranium-Total	3	15.87		1.87	1.20	2.30	PCI/G

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.3-7 (cont.): Background Summary Statistics for Seep/Spring Sediments

Water Quality Parameters

Analyte Name	Sample Size (N)	BUTL 1)	Max. Conc. 2)	Mean	Minimum	Maximum	Unit
Alkalinity	8	173,110.00		14,192.25	68.00	81,000.00	MG/KG
Nitrate/Nitrite	17	19.89		4.14	0.90	17.10	MG/KG
Nitrite	3	37.91		1.33	0.40	3.10	MG/KG
Percent Solids	1	60.70	60.70	60.70	60.70	60.70	%
Total Alkalinity	4	19,329.11		750.25			MG/KG
pH	18	9.47		7.24	6.10	7.90	PH

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.3-8: Status of Sample Analysis and Validation (Status Date - January 28, 1994)

(By analyte and sampling event, samples are listed as percent analyzed and percent validated.)

IHSS	SAMPLING EVENT	Volatile Organics		Semi-Volatile Organics		Radionuclides		Metals		Pesticides /PCBs		Water Quality Parameters	
115	Stage 3 - Characterization Borings	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	NA	NA
	Stage 3 - Surface Soils	100%	100%	97%	97%	97%	97%	100%	100%	100%	100%	100%	100%
	Stage 3 - Surface Soils from HPGe Anomalies	NA	NA	NA	NA	38%	0%	NA	NA	NA	NA	NA	NA
	Stage 3 - Seep/Spring Sediment Samples	100%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%
	Stage 3 - Soil Gas Borings	100%	74%	100%	87%	93%	73%	100%	100%	100%	87%	NA	NA
	Stage 3 - Hydropunch Samples from Soil Gas Borings	100%	0%	NA	NA	100%	0%	100%	100%	NA	NA	NA	NA
	Stage 3 - Groundwater Samples from Wellpoints	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Stage 4 - Borehole Samples from Monitoring Wells	100%	100%	100%	100%	0%	0%	100%	100%	100%	100%	NA	NA
	Stage 4 - 1st Quarter Groundwater Samples	100%	100%	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%
	Stage 4 - 2nd Quarter Groundwater Samples	0%	0%	0%	0%	100%	100%	0%	0%	NA	NA	0%	0%
	Stage 4 - Groundwater Samples from Wellpoints	100%	100%	100%	100%	100%	67%	100%	100%	100%	100%	100%	100%
	Stage 4 - Groundwater Samples from Seep/Spring Wellpoints	100%	100%	NA	NA	100%	50%	NA	NA	NA	NA	NA	NA
	Stage 5 - Sample from Storm Sewer Outfall	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
133	Stage 3 - Characterization Borings	NA	NA	NA	NA	100%	100%	97%	97%	NA	NA	NA	NA
	Stage 3 - Hydropunch Samples from Borings	NA	NA	NA	NA	100%	50%	100%	100%	NA	NA	NA	NA
	Stage 3 - Surface Soils	NA	NA	NA	NA	69%	27%	100%	100%	100%	100%	100%	100%
	Stage 3 - Seep/Spring Sediment Samples	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Stage 3 - Borings in Magnetic Anomaly	NA	NA	NA	NA	23%	0%	77%	77%	NA	NA	NA	NA
	Stage 4 - Borehole Samples from Monitoring Wells	NA	NA	NA	NA	12%	12%	100%	79%	NA	NA	NA	NA
	Stage 4 - 1st Quarter Groundwater Samples	NA	NA	NA	NA	100%	100%	100%	100%	100%	100%	100%	100%
	Stage 4 - 2nd Quarter Groundwater Samples	NA	NA	NA	NA	100%	0%	100%	100%	100%	100%	100%	100%
	Stage 4 - Groundwater Samples from Seep/Spring Wellpoints	100%	100%	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%
142	Stage 3 - Surface Water	100%	100%	100%	100%	100%	87%	100%	100%	100%	100%	100%	100%
	Stage 3 - Sediment Samples	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Stage 4 - Borehole Samples from Monitoring Wells	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	NA	NA
	Stage 4 - 1st Quarter Groundwater Samples (50092, 50192, 50292)	100%	100%	100%	100%	100%	100%	NA	NA	100%	100%	100%	100%
	Stage 4 - 2nd Quarter Groundwater Samples (50092, 50192, 50292)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	NA	NA
	Stage 4 - 1st Quarter Groundwater Samples (51193)	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%	100%	100%
	Stage 4 - 2nd Quarter Groundwater Samples (51193)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	NA	NA
209	Stage 3 - Characterization Borings	96%	96%	100%	100%	94%	94%	100%	78%	100%	100%	NA	NA
	Stage 3 - Surface Soils	NA	NA	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Stage 3 - Surface Water	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 2.4.3.1-1a: Summary of Constituents Exceeding Background
IHSS 115 Stage 3 Surface Soils

Metals

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Copper	30.03		54	13	5.40	184.00	28.77	MG/KG
Lead	63.12		34	1	5.80	129.00	23.18	MG/KG
Silver	5.00	5.00	43	2	1.00	94.30	3.51	MG/KG
Zinc	97.20		40	5	15.90	199.00	56.74	MG/KG

Radionuclides

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Americium-241	0.06		55	2	-0.19	0.08	0.01	PCI/G
Plutonium-239/240	0.13		56	4	-0.13	0.21	0.04	PCI/G
Uranium-233/234	1.76		58	8	0.22	2,800.00	55.98	PCI/G
Uranium-235	0.19		57	6	0.00	670.00	13.37	PCI/G
Uranium-238	1.90		58	13	0.28	38,000.00	723.20	PCI/G

Pesticides/PCBs

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
4,4'-DDT	16.00	53	1	4.00	21.00	8.17	UG/KG
ALDRIN	8.00	51	1	4.00	17.00	4.25	UG/KG
AROCLOR-1254	160.00	49	8	4.00	3,900.00	286.71	UG/KG
DIELDRIN	16.00	51	1	4.00	34.00	8.43	UG/KG
ENDOSULFAN SULFATE	16.00	53	1	4.00	24.00	8.23	UG/KG
ENDRIN KETONE	16.00	53	1	4.00	36.00	8.45	UG/KG
HEPTACHLOR EPOXIDE	8.00	53	1	4.00	10.00	4.11	UG/KG
METHOXYCHLOR	80.00	53	1	4.00	450.00	47.06	UG/KG

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.4.3.1-1a (cont.): Summary of Constituents Exceeding Background
IHSS 115 Stage 3 Surface Soils

Semi-Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
2-METHYLNAPHTHALENE	330.00	51	4	132.50	12,000.00	408.38	UG/KG
ACENAPHTHENE	330.00	52	17	56.00	44,000.00	1,059.28	UG/KG
ACENAPHTHYLENE	330.00	52	1	165.00	600.00	173.37	UG/KG
ANTHRACENE	330.00	52	19	69.00	47,000.00	1,141.95	UG/KG
BENZO(a)ANTHRACENE	330.00	50	27	64.00	45,000.00	1,308.39	UG/KG
BENZO(a)PYRENE	330.00	52	23	73.00	41,000.00	1,164.95	UG/KG
BENZO(b)FLUORANTHENE	330.00	49	21	87.00	5,500.00	518.48	UG/KG
BENZO(ghi)PERYLENE	330.00	31	13	54.00	6,900.00	498.10	UG/KG
BENZO(k)FLUORANTHENE	330.00	51	15	56.00	2,100.00	262.67	UG/KG
BENZOIC ACID	1,600.00	19	3	170.00	800.00	714.74	UG/KG
BIS(2-ETHYLHEXYL)PHTHALATE	330.00	52	8	66.00	165.00	154.47	UG/KG
BUTYL BENZYL PHTHALATE	330.00	52	1	165.00	220.00	166.06	UG/KG
CHRYSENE	330.00	51	28	68.00	46,000.00	1,333.88	UG/KG
DI-n-BUTYL PHTHALATE	330.00	52	8	40.00	200.00	154.90	UG/KG
DI-n-OCTYL PHTHALATE	330.00	52	1	83.00	165.00	163.42	UG/KG
DIBENZO(a,h)ANTHRACENE	330.00	38	5	60.00	7,000.00	363.39	UG/KG
DIBENZOFURAN	330.00	52	8	49.00	20,000.00	563.55	UG/KG
FLUORANTHENE	330.00	52	41	68.00	140,000.00	3,541.64	UG/KG
FLUORENE	330.00	52	15	39.00	39,000.00	952.26	UG/KG
INDENO(1,2,3-cd)PYRENE	330.00	40	16	52.00	32,000.00	1,072.84	UG/KG
NAPHTHALENE	330.00	52	7	39.00	41,000.00	1,003.70	UG/KG
PHENANTHRENE	330.00	52	35	48.00	170,000.00	3,897.29	UG/KG
PYRENE	330.00	51	39	59.00	120,000.00	3,074.23	UG/KG

Table 2.4.3.1-1b: Summary of Constituents Exceeding Background
IHSS 115 Stage 3 Seep/Spring Sediment Samples

Metals

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Antimony	41.04		2	1	36.50	51.30	43.90	MG/KG

Semi-Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
BENZO(a)ANTHRACENE	330.00	2	1	38.00	165.00	101.50	UG/KG
BIS(2-ETHYLHEXYL)PHTHALATE	330.00	2	1	68.00	165.00	116.50	UG/KG
CHRYSENE	330.00	2	1	41.00	165.00	103.00	UG/KG
FLUORANTHENE	330.00	2	2	96.00	97.00	96.50	UG/KG
PHENANTHRENE	330.00	2	2	76.00	82.00	79.00	UG/KG
PYRENE	330.00	2	2	73.00	97.00	85.00	UG/KG

Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
TETRACHLOROETHENE	5.00	2	1	1.00	2.50	1.75	UG/KG

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.4.3.2-1: Summary of Constituents Exceeding Background
IHSS 115 Stage 3 Characterization Boreholes

Metals

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Barium	321.20		28	1	39.50	387.00	103.66	MG/KG
Copper	42.43		28	2	6.10	65.70	16.80	MG/KG
Lead	27.29		13	1	2.90	99.50	14.32	MG/KG
Manganese	1,014.41		28	1	64.60	1,540.00	224.03	MG/KG
Zinc	155.97		28	2	11.60	284.00	53.16	MG/KG

Radionuclides

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Americium-241	0.02		28	2	-0.00	0.05	0.01	PCI/G
Plutonium-239/240	0.02		28	5	-0.00	0.09	0.01	PCI/G
Uranium-238	1.73		28	1	0.56	3.10	1.17	PCI/G

Pesticides/PCBs

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
AROCLOR-1254	160.00	28	5	80.00	870.00	156.07	UG/KG
AROCLOR-1260	160.00	28	3	80.00	1,300.00	166.43	UG/KG
alpha-BHC	8.00	28	1	4.00	15.00	4.39	UG/KG

Semi-Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
2-METHYLNAPHTHALENE	330.00	28	4	96.00	230.00	164.86	UG/KG
ACENAPHTHENE	330.00	28	5	92.00	680.00	218.46	UG/KG
ANTHRACENE	330.00	28	5	140.00	940.00	247.32	UG/KG
BENZO(a)ANTHRACENE	330.00	28	7	44.00	1,300.00	279.96	UG/KG
BENZO(a)PYRENE	330.00	28	5	47.00	1,300.00	276.14	UG/KG
BENZO(b)FLUORANTHENE	330.00	28	6	81.00	1,500.00	291.46	UG/KG
BENZO(ghi)PERYLENE	330.00	28	5	165.00	680.00	226.61	UG/KG
BENZO(k)FLUORANTHENE	330.00	28	5	120.00	670.00	208.04	UG/KG
BENZOIC ACID	1,600.00	26	7	110.00	800.00	645.92	UG/KG
BIS(2-ETHYLHEXYL)PHTHALATE	330.00	28	4	61.00	165.00	150.68	UG/KG
CHRYSENE	330.00	28	7	52.00	1,400.00	288.82	UG/KG
DIBENZO(a,h)ANTHRACENE	330.00	28	5	53.00	250.00	165.64	UG/KG
DIBENZOFURAN	330.00	28	4	150.00	290.00	173.57	UG/KG
FLUORANTHENE	330.00	28	6	75.00	3,300.00	524.82	UG/KG
FLUORENE	330.00	28	5	86.00	610.00	211.11	UG/KG
INDENO(1,2,3-cd)PYRENE	330.00	28	5	165.00	930.00	249.11	UG/KG
NAPHTHALENE	330.00	28	4	165.00	820.00	217.50	UG/KG
PENTACHLOROPHENOL	1,600.00	28	1	160.00	800.00	777.14	UG/KG
PHENANTHRENE	330.00	28	6	165.00	3,500.00	570.36	UG/KG
PHENOL	330.00	28	4	53.00	165.00	152.64	UG/KG
PYRENE	330.00	28	7	73.00	2,500.00	440.64	UG/KG

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.4.3.2-1 (cont.): Summary of Constituents Exceeding Background
IHSS 115 Stage Characterization Boreholes

Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
2-BUTANONE	10.00	46	3	5.00	69.00	6.85	UG/KG
ACETONE	10.00	59	5	5.00	37.00	6.78	UG/KG
METHYLENE CHLORIDE	5.00	71	16	1.00	38.00	3.54	UG/KG
TETRACHLOROETHENE	5.00	71	4	2.00	9.00	2.65	UG/KG
TOLUENE	5.00	71	50	1.00	220.00	21.22	UG/KG
TRICHLOROETHENE	5.00	71	3	2.00	3.00	2.49	UG/KG

Table 2.4.3.3-1: Summary of Constituents Exceeding Background
IHSS 115 Stage 3 Soil Gas Boreholes

Metals

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Cadmium	2.17		17	2	0.50	2.30	0.87	MG/KG
Chromium	76.30		17	2	4.40	165.00	25.93	MG/KG
Copper	42.43		17	7	2.50	749.00	94.66	MG/KG
Iron	45,421.42		16	1	7,400.00	49,500.00	17,544.38	MG/KG
Lead	27.29		3	1	11.80	80.20	36.97	MG/KG
Molybdenum	67.60	67.60	16	1	0.99	190.00	25.28	MG/KG
Nickel	69.05		17	3	4.00	118.00	29.38	MG/KG
Zinc	155.97		17	6	17.00	648.00	156.82	MG/KG

Radionuclides

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Americium-241	0.02		13	3	-0.00	0.46	0.05	PCI/G
Plutonium-239/240	0.02		13	7	0.00	3.20	0.37	PCI/G
Uranium-233/234	3.25		13	3	0.72	30.00	4.83	PCI/G
Uranium-235	0.14		13	4	0.03	2.30	0.30	PCI/G
Uranium-238	1.73		13	4	1.10	12.00	2.85	PCI/G

Pesticides/PCBs

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
AROCLOR-1254	160.00	12	3	80.00	860.00	185.83	UG/KG
HEPTACHLOR EPOXIDE	8.00	14	1	4.00	11.00	4.50	UG/KG

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.4.3.3-1 (cont.): Summary of Constituents Exceeding Background
IHSS 115 Stage 3 Soil Gas Boreholes

Semi-Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
2-METHYLNAPHTHALENE	330.00	13	2	5.00	390.00	135.54	UG/KG
ACENAPHTHENE	330.00	13	5	5.00	930.00	169.54	UG/KG
ANTHRACENE	330.00	13	5	5.00	1,500.00	233.15	UG/KG
BENZO(a)ANTHRACENE	10.00	13	1	5.00	1,500.00	309.62	UG/KG
BENZO(a)ANTHRACENE	330.00	13	5	5.00	1,500.00	309.62	UG/KG
BENZO(a)PYRENE	10.00	13	1	5.00	1,400.00	274.08	UG/KG
BENZO(a)PYRENE	330.00	13	5	5.00	1,400.00	274.08	UG/KG
BENZO(b)FLUORANTHENE	10.00	13	1	5.00	1,500.00	337.65	UG/KG
BENZO(b)FLUORANTHENE	330.00	13	5	5.00	1,500.00	337.65	UG/KG
BENZO(ghi)PERYLENE	10.00	13	1	5.00	470.00	149.77	UG/KG
BENZO(ghi)PERYLENE	330.00	13	4	5.00	470.00	149.77	UG/KG
BENZO(k)FLUORANTHENE	10.00	13	1	5.00	620.00	191.50	UG/KG
BENZO(k)FLUORANTHENE	330.00	13	5	5.00	620.00	191.50	UG/KG
BENZOIC ACID	1,600.00	13	2	25.00	800.00	509.62	UG/KG
BIS(2-ETHYLHEXYL)PHTHALATE	330.00	13	4	5.00	290.00	114.00	UG/KG
BUTYL BENZYL PHTHALATE	330.00	13	1	5.00	165.00	120.69	UG/KG
CHRYSENE	10.00	13	1	5.00	1,500.00	323.46	UG/KG
CHRYSENE	330.00	13	5	5.00	1,500.00	323.46	UG/KG
DI-n-BUTYL PHTHALATE	330.00	13	2	5.00	300.00	133.08	UG/KG
DIBENZO(a,h)ANTHRACENE	330.00	13	1	5.00	165.00	126.92	UG/KG
DIBENZOFURAN	330.00	13	2	5.00	580.00	151.00	UG/KG
FLUORANTHENE	10.00	13	2	5.00	3,500.00	657.92	UG/KG
FLUORANTHENE	330.00	13	7	5.00	3,500.00	657.92	UG/KG
FLUORENE	330.00	13	5	5.00	1,000.00	171.54	UG/KG
INDENO(1,2,3-cd)PYRENE	330.00	13	3	5.00	550.00	151.38	UG/KG
ISOPHORONE	330.00	13	1	5.00	165.00	121.69	UG/KG
NAPHTHALENE	330.00	13	2	5.00	1,200.00	200.85	UG/KG
PHENANTHRENE	10.00	13	2	5.00	4,100.00	634.69	UG/KG
PHENANTHRENE	330.00	13	8	5.00	4,100.00	634.69	UG/KG
PYRENE	10.00	13	2	5.00	3,000.00	598.85	UG/KG
PYRENE	330.00	13	7	5.00	3,000.00	598.85	UG/KG

Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
1,1,1-TRICHLOROETHANE	5.00	29	1	2.00	2.50	2.48	UG/KG
2-BUTANONE	10.00	29	1	5.00	7.00	5.07	UG/KG
4-METHYL-2-PENTANONE	10.00	28	1	2.00	5.00	4.89	UG/KG
ACETONE	10.00	28	11	5.00	250.00	23.36	UG/KG
METHYLENE CHLORIDE	5.00	29	1	2.50	14.00	2.90	UG/KG
TETRACHLOROETHENE	5.00	29	7	2.00	250.00	18.62	UG/KG
TOLUENE	5.00	29	2	2.50	4.00	2.57	UG/KG
TRICHLOROETHENE	5.00	29	9	1.00	110.00	7.90	UG/KG

Table 2.4.3.3-2: Summary of Constituents Exceeding Background
IHSS 115 Stage 3 Soil Gas Hydropunch

Metals

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Aluminum, Total	12,642.33		1	1	343,000.00	343,000.00	343,000.00	UG/L
Arsenic, Total	5.93		1	1	7.30	7.30	7.30	UG/L
Barium, Total	208.14		1	1	4,710.00	4,710.00	4,710.00	UG/L
Beryllium, Total	4.80	4.80	1	1	58.60	58.60	58.60	UG/L
Cadmium, Total	11.10	11.10	1	1	67.50	67.50	67.50	UG/L
Calcium, Total	128,816.15		1	1	622,000.00	622,000.00	622,000.00	UG/L
Chromium, Total	22.58		1	1	563.00	563.00	563.00	UG/L
Cobalt, Total	39.40	39.40	1	1	606.00	606.00	606.00	UG/L
Copper, Total	39.12		1	1	3,460.00	3,460.00	3,460.00	UG/L
Iron, Total	14,654.53		1	1	537,000.00	537,000.00	537,000.00	UG/L
Lithium, Total	147.37		1	1	207.00	207.00	207.00	UG/L
Magnesium, Total	28,854.11		1	1	118,000.00	118,000.00	118,000.00	UG/L
Manganese, Total	331.64		1	1	37,100.00	37,100.00	37,100.00	UG/L
Mercury, Total	0.22		1	1	8.40	8.40	8.40	UG/L
Nickel, Total	32.68		1	1	1,160.00	1,160.00	1,160.00	UG/L
Potassium, Total	4,472.65		1	1	60,900.00	60,900.00	60,900.00	UG/L
Silicon, Total	48,399.65		1	1	107,000.00	107,000.00	107,000.00	UG/L
Strontium, Total	944.25		1	1	2,750.00	2,750.00	2,750.00	UG/L
Vanadium, Total	46.64		1	1	1,120.00	1,120.00	1,120.00	UG/L
Zinc, Total	153.21		1	1	41,300.00	41,300.00	41,300.00	UG/L

Radionuclides

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Gross Beta, Total	221.31		1	1	290.00	290.00	290.00	PCI/L

Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
TETRACHLOROETHENE	5.00	1	1	16.00	16.00	16.00	UG/L

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.4.3.4-1
OU5-FSP-Related Surface-Water Monitoring Sites
Woman Creek Drainage Basin

Site[1]	Status	Purpose	Sampling Frequency[3]	Equipment[4]	Analytes
SW107 SED016	Permanent[2]	Upstream end of Woman Creek	Quarterly, 2S, 2B One-time, fall	9" Parshall Flume Flow Recorder Automatic Sampler	U.S. DOE, 1992a[5]; ASI, 1993b, amended.
SW040	Temporary	Flow from Ash Pits, IHSS	2B	6" Portable Cutthroat Flume	U.S. DOE, 1992a[5]; ASI, 1993b, amended.
SW127 SED127	Permanent[2]	Upstream end of S.Woman Creek	Quarterly, 2S, 2B One-time, fall	9" Parshall Flume Flow Recorder Automatic Sampler	U.S. DOE, 1992a[5]; ASI, 1993b, amended.
SW041 SED017	Temporary	Flow from disturbed area	2B One-time, fall	4" Portable Cutthroat Flume	U.S. DOE, 1992a[5]; ASI, 1993b, amended.
SW506 SED506	Temporary	Flow from IHSS and seeps	Quarterly, 2S, 2B One-time, fall	9" Parshall Flume Flow Recorder Automatic Sampler	U.S. DOE, 1992a[5]; ASI, 1993b, amended.
SW50293	Temporary	Flows from apple orchard seep	1B	None	U.S. DOE, 1992a[5]; ASI, 1993b, amended.
SW50193	Temporary	Flow from landfill seep	1B	2" Portable Cutthroat Flume	U.S. DOE, 1992a[5]; ASI, 1993b, amended.
SW033	Temporary	Woman Ck. upstream from Antelope Spring Ck.	2B	4" Portable Cutthroat Flume	U.S. DOE, 1992a[5]; ASI, 1993b, amended.
SW034	Temporary	Flow from Antelope Spring Ck.	Quarterly, 2S, 2B	6" Parshall Flume Flow Recorder Automatic Sampler	U.S. DOE, 1992a[5]; ASI, 1993b, amended.
SW501 SED501	Temporary	Flow into Pond C-1 and seepage from SID	Quarterly, 2S, 2B One-time, fall	9" Parshall Flume Flow Recorder Automatic Sampler	U.S. DOE, 1992a[5]; ASI, 1993b, amended.

Table 2.4.3.4-1 (Concluded)
OU5-FSP-Related Surface-Water Monitoring Sites
Woman Creek Drainage Basin

Site[1]	Status	Purpose	Sampling Frequency[3]	Equipment[4]	Analytes
SW-C1	Pond	Pond C-1 Water Quality	Quarterly with HydroLab	None	Temp., pH, SC, DO, at 6-in. intervals with depth at the deepest location
SED508 SED509 SED510	Pond	Pond C-1 bottom sediment quality	One-time, fall	None	ASI, 1993b, amended.
SW029 SED027	Permanent[2]	Discharge from Pond C-1	Quarterly, 2S, 2B One time, fall	9" Parshall Flume 90° V-Notch Weir Flow Recorder Automatic Sampler	U.S. DOE, 1992a[5];ASI, 1993b, amended.
IHSS209	Temporary	Water in disturbed area in IHSS 209	One-time, spring	None	U.S. DOE, 1992a[5]
SW55193	Temporary	Water in disturbed area in IHSS 209	One-time, spring	None	U.S. DOE, 1992a[5]
SW507 SED507	Temporary	Flow in SID adjacent to old landfill	Quarterly 4S One-time, fall	None	U.S. DOE, 1992a[5];ASI, 1993b,amended.
SW500	Temporary	Flows from storm sewer discharge into SID	One-time, fall	None	U.S. DOE, 1992a[5]
SW027 SED025	Temporary (Stormwater NPDES)	Inflow to Pond C-2	Quarterly, 2S, 2B One time, fall	Rated Section Flow Recorder Automatic Sampler	U.S. DOE, 1992a[5];ASI, 1993b, amended.
SED511 SED512 SED513	Pond	Pond C-2 bottom sediment quality	One-time, fall	None	ASI, 1993b, amended.
SW026 SED024	Permanent[2]	Downstream Woman Ck, outflow from Pond C-2	Quarterly, 2S, 2B One-time, fall	9" Parshall Flume Flow Recorder Automatic Sampler	U.S. DOE, 1992a[5];ASI, 1993b, amended.

1) Locations are shown on Figure 2.4.3.4-1.
2) Part of current site-wide monitoring program, EG&G (1992b; 1992d).
3) S = stormflow sample; B = baseflow sample.
4) Equipment status as reported by Greg Wetherbee, EG&G, in March 25, 1994 pers. comm.
5) Except volatiles for samples from automatic sampler.

Table 2.4.3.4-2
Woman Creek Drainage OU5-FSP-Related
Surface-Water and Sediment Monitoring-Site Descriptions

Surface-Water Site[1]	Sediment Site[1]	Programmatic Driver(s)[2]	Site Monitors Runoff from These OU5 IHSSs
SW107	SED016	B,C,D	Upstream from OU5
SW040	--	B,C	133.1, 133.4, 133.5, 133.6
SW127	SED127	B,C,D	Upstream from OU5
SW041	SED017	B,C	Surface Disturbance South of Ash Pits
SW506	SED506	B,C	133.1, 133.3, 133.4, 133.5, 133.6, Surface Disturbance South of Ash Pits
SW50293	--	B	Surface Disturbance South of Ash Pits
SW50193	--	B	115
SW033	--	B,C	115, 133.1, 133.2, 133.3, 133.4, 133.5, 133.6, 196, Surface Disturbance South of Ash Pits
SW034	--	B,C	None
SW501	SED501	B,C	Same as SW033
SW-C1	SED508[3] SED509[4] SED510[5]	B,E	115, 133.1, 133.2, 133.3, 133.4, 133.5, 133.6, 142.10, 196, SE-1601.2, Surface Disturbance South of Ash Pits, Surface Disturbance West of IHSS 209
SW029	SED027	B,C	Same as SW-C2
IHSS209	--	B	209
SW55193	--	B	209
SW507	SED507	B,C	115
SW500	--	B	None
SW027	SED025	A,B	115, SE-1600, SE-1601.1, Surface Disturbance East of Landfill
SW-C2	SED511[3] SED512[4] SED513[5]	B,E,F	142.11 (except during 100-yr flood or larger when all IHSSs contribute)
SW026	SED024	B,C	All IHSSs in OU5 (except 142.11 unless Pond C-2 is discharging)

1) Locations are shown on Figure 2.4.3.4-1.
2) A=Critical station for support of NPDES-related activities; B=Operable unit RI/FS and RI/CMS; C=General site characterization under DOE Order 5400.1; D=Storm-event monitoring under DOE Order 5400.1; E=Federal Facility Compliance Agreement (FFCA); F=Agreement in Principle (AIP).
3) 5-ft from inlet to pond
4) Mid-point of pond
5) Deepest Point of pond

Adapted from: EG&G (1991f, Table 4).

Table 2.4.3.4-3
Schedule of Chemical-Constituent Analyses, OU5-FSP-Related Surface-Water and Sediment Samples

SURFACE WATER	Radionuclides: Unfiltered: Gross Alpha	Radionuclides: Unfiltered: Gross Beta	Radionuclides: Filtered: Cs 137	Radionuclides: Filtered: Sr 89/90	Radionuclides: Filtered and Unfiltered: Am 241	Radionuclides: Filtered and Unfiltered: Pu 239/240	Radionuclides: Filtered and Unfiltered: U 233/234	Radionuclides: Filtered and Unfiltered: U 235	Radionuclides: Filtered and Unfiltered: U 238	Trace Metals: Unfilt.: TAL Metals	Trace Metals: Filtered: Cr (Total)	Trace Metals: Filtered: Pb	Water Quality: Filtered: Anions & TDS	Water Quality: Unfiltered: Nitrate/ Nitrite	Water Quality: Unfiltered: TCL [1] Pest.	VOC: Unfiltered: TCL [1] Vols	VOC: Unfiltered: TCL [1] Semi-Vols	Toxicity: Unfiltered: Micro and Acute
SW107	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	
SW040	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x
SW127	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x
SW041	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x
SW506	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	
SW50293	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x
SW50193	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x
SW033	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x
SW034	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x
SW501	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	
SW029	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	
BISS209	x	x			x [2]	x [2]	x [2]	x [2]	x [2]	x						x	x	
SW55193	x	x			x [2]	x [2]	x [2]	x [2]	x [2]	x						x	x	
SW507	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x
SW500	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
SW027	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x
SW026	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x

POND C-1

SW-C1 HydroLab only (water temperature, pH, specific conductance, dissolved oxygen, and redox potential)

1) These organic analyses are only for the two base-flow sampling surveys.
2) Unfiltered samples only.

SEDIMENT	Radionuclides: Gross Alpha	Radionuclides: Gross Beta	Radionuclides: Am 241	Radionuclides: Cs 137	Radionuclides: Pu 239/240	Radionuclides: Sr 89/90	Radionuclides: Tritium	Radionuclides: U 233/234	Radionuclides: U 235	Radionuclides: U 238	Trace Metals: TAL Metals	Water Quality: Nitrate/ Nitrite	Water Quality: TOC	VOC: TCL Vols	VOC: TCL Semi-Vols	Toxicity: Micro and Acute
IN-STREAM																
SED016	x	x	x		x			x	x	x	x	x	x			
SED127																x
SED017	x	x	x		x			x	x	x	x	x	x			
SED506	x	x	x		x			x	x	x	x	x	x			x
SED501	x	x	x		x			x	x	x	x	x	x			x
SED027	x	x	x		x		x	x	x	x	x	x	x			
SED507	x	x	x		x			x	x	x	x	x	x			
SED025	x	x	x		x			x	x	x	x	x	x			
SED024	x	x	x		x		x	x	x	x	x	x	x			
POND C-1																
SED508	x	x	x	x [3]	x	x [3]	x [3]	x	x	x	x [3]	x [3]	x	x [3]	x [3]	
SED509	x	x	x	x [3]	x	x [3]	x [3]	x	x	x	x [3]	x [3]	x	x [3]	x [3]	
SED510	x	x	x	x [3]	x	x [3]	x [3]	x	x	x	x [3]	x [3]	x	x [3]	x [3]	x
POND C-2																
SED511	x	x	x	x [3]	x	x [3]	x [3]	x	x	x	x [3]	x [3]	x	x [3]	x [3]	
SED512	x	x	x	x [3]	x	x [3]	x [3]	x	x	x	x [3]	x [3]	x	x [3]	x [3]	
SED513	x	x	x	x [3]	x	x [3]	x [3]	x	x	x	x [3]	x [3]	x	x [3]	x [3]	x

3) These analyses apply only to the top 6 inches of the sediment core. Core samples with lengths greater than 6 inches will be divided into 6-inch segments and each segment will be analyzed for only the radionuclides.

Table 2.4.3.4-4
OU5 - FSP-Related Sample-Inventory Summary [1)]

Site [2)]	Sample Date	Type [3)]	Rads	Metals	Wtr Qual	VOA	Toxicity	Sample ID
Surface Water								
SW107	04-Nov-92	B	+	1	+	1	--	SW50224WC
SW107	24-Mar-93	B	+	+	+	4	--	SW50214JE
SW040	04-Nov-92	B	+	1	+	1	+	SW50223WC
SW040	24-Mar-93	B	+	2	+	6	--	SW50211JE
SW127	24-Mar-93	B	+	+	+	6	+	SW50216JE
SW041	24-Mar-93	B	+	1	+	3	+	SW50215JE
SW506	04-Nov-92	B	+	2	+	1	--	SW50222WC
SW506	24-Mar-93	B	+	2	+	4	--	SW50209JE
SW50293	24-Mar-93	B	+	2	+	4	+	SW50210JE
SW50193	24-Mar-93	B	+	2	+	4	+	SW50208JE
SW033	04-Nov-92	B	+	+	+	1	+	SW50221WC
SW033	24-Mar-93	B	+	2	+	4	--	SW50207JE
SW034	04-Nov-92	B	+	1	+	1	+	SW50220WC
SW034	24-Mar-93	B	+	1	+	2	--	SW50206JE
SW501	04-Nov-92	B	+	1	+	1	--	SW50219WC
SW501	24-Mar-93	B	+	2	+	2	--	SW50205JE
SW029	04-Nov-92	B	1	1	+	1	--	SW50216WC
SW029	24-Mar-93	B	+	1	+	2	--	SW50204JE
IHSS209	18-Mar-93	O	+	+	+ [4)]	3	--	SW50009JE
SW55193	24-May-93	O	+	+	+ [4)]	+	--	SW70040JE
SW507	24-Mar-93	B	+	1	+	2	--	SW50203JE
SW507	29-Mar-93	S	+	+	+	4	+	SW50217JE
SW507	17-May-93	S	+	+	+	1	--	SW50221JE
SW500	05-Oct-92	O	+	+	+	+	--	SW50000AS
SW027	29-Mar-93	S	+	1	+	3	+	SW50218JE
SW027	17-May-93	S	+	+	+	1	--	SW50222JE
SW026	04-Nov-92	B	+	+	+	1	+	SW50213WC
SW026	24-Mar-93	B	+	1	+	2	--	SW50201JE
Stream Sediment								
SED016	05-Nov-92	O	3	+	+	–	--	SD50010WC
SED127	05-Nov-92	O	–	--	–	–	+	SD50012WC
SED017	05-Nov-92	O	3	•	+	–	--	SD50009WC
SED506	05-Nov-92	O	4	+	+	–	--	SD50008WC
SED506	09-Nov-92	O	–	--	–	–	+	SD50022WC
SED501	05-Nov-92	O	3	+	+	–	+	SD50004WC
SED027	05-Nov-92	O	3	+	+	–	--	SD50003WC
SED507	05-Nov-92	O	3	6	+	–	--	SD50005WC
SED025	05-Nov-92	O	3	+	+	–	--	SD50002WC
SED024	05-Nov-92	O	+	+	+	–	--	SD50001WC
Pond-Bottom Sediment								
SED508	09-Nov-92	O	+	1	+	+	--	SD50014WC
SED509	09-Nov-92	O	+	7	+	91	--	SD50016WC
SED510	09-Nov-92	O	+	1	+	1	+	SD50017WC
SED511	10-Nov-92	O	3	1	+	+	--	SD50023WC
SED512	10-Nov-92	O	3	1	+	+	--	SD50024WC
SED513	10-Nov-92	O	4	8	+	92	+	SD50025WC

1) values = number of analytes rejected; + = all data received from RFEDS; -- = no analyses requested.
2) Locations are shown on Figure 2.4.3.4-1.
3) B - baseflow survey; S - storm event; O - one-time (low-flow) survey.
4) Not included in specified analyses (Table 2.4.3.4-3).

Table 2.4.3.4-5: Summary of Constituents Exceeding Background
IHSS 115 Stage 3 Surface Water

Metals

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Barium, Dissolved	127.74		26	5	38.10	160.00	90.43	UG/L
Barium, Total	138.11		26	5	38.30	187.00	93.79	UG/L
Calcium, Dissolved	50,358.44		26	12	16,100.00	79,700.00	45,584.62	UG/L
Calcium, Total	49,464.66		26	13	16,400.00	80,700.00	45,503.85	UG/L
Iron, Dissolved	560.62		26	1	50.00	3,180.00	197.21	UG/L
Iron, Total	7,926.75		26	1	50.00	11,200.00	660.66	UG/L
Lead, Total	7.36		26	1	1.00	9.50	1.77	UG/L
Magnesium, Dissolved	9,800.47		26	10	4,120.00	22,900.00	9,894.04	UG/L
Magnesium, Total	9,812.65		26	10	4,210.00	23,000.00	9,906.54	UG/L
Manganese, Dissolved	139.22		26	1	1.10	274.00	27.71	UG/L
Potassium, Dissolved	3,585.92		26	2	601.00	5,540.00	1,777.27	UG/L
Potassium, Total	4,167.09		26	2	843.00	5,380.00	1,818.77	UG/L
Sodium, Dissolved	34,096.80		26	2	6,150.00	43,200.00	21,267.69	UG/L
Sodium, Total	33,817.24		26	1	6,000.00	41,250.00	21,350.38	UG/L

Radionuclides

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Amercium-241, Total	0.02		22	3	-0.00	0.38	0.03	PCI/L
Plutonium-239/240, Total	0.02		23	1	-0.07	0.03	-0.00	PCI/L
Uranium-233/234, Total	2.16		25	2	0.03	4.67	1.10	PCI/L
Uranium-238, Total	1.73		25	3	0.00	7.00	1.14	PCI/L

Water Quality Parameters

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Carbonate	7.51		26	2	0.50	44.00	3.39	MG/L
Chloride	53.20		26	4	1.00	63.00	31.67	MG/L
Dissolved Organic Carbon	17.00		22	3	3.00	33.00	8.07	MG/L
Fluoride	0.59		26	3	0.20	0.70	0.44	MG/L
Sulfate	37.83		26	5	2.50	47.00	25.27	MG/L
Total Dissolved Solids	302.28		26	4	87.00	380.00	224.69	MG/L
Total Organic Carbon	22.05		26	1	2.00	41.00	6.58	MG/L

Semi-Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
BENZOIC ACID	50.00	25	1	15.50	25.00	24.62	UG/L
PENTACHLOROPHENOL	50.00	25	1	5.00	25.00	24.20	UG/L

Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
METHYLENE CHLORIDE	5.00	26	1	2.50	3.50	2.54	UG/L

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.4.3.4-6: Summary of Constituents Exceeding Background
IHSS 115 Stage 3 Sediments

Metals

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Barium	253.82		14	1	26.60	262.00	132.96	MG/KG
Cadmium	2.55		12	1	0.50	2.80	0.86	MG/KG
Calcium	18,446.12		14	2	1,430.00	47,700.00	11,493.57	MG/KG
Copper	36.78		14	1	2.50	135.50	24.28	MG/KG
Mercury	0.46		14	7	0.05	3.05	0.67	MG/KG
Silver	3.11		12	1	1.00	7.70	1.56	MG/KG
Zinc	139.04		6	2	44.60	201.00	108.80	MG/KG

Radionuclides

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Tritium	1,030.59		17	1	-59.00	3,900.00	496.24	PCI/L

Water Quality Parameters

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Total Organic Carbon	24,000.00	24,000.00	14	3	11,000.00	29,000.00	20,178.57	MG/KG

Semi-Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
BENZOIC ACID	1,600.00	5	4	190.00	800.00	410.00	UG/KG
DI-n-BUTYL PHTHALATE	330.00	4	1	110.00	165.00	151.25	UG/KG
FLUORANTHENE	330.00	4	1	140.00	197.50	166.88	UG/KG
PHENOL	330.00	4	1	150.00	165.00	161.25	UG/KG

Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
TOLUENE	5.00	6	6	340.00	530.00	425.00	UG/KG

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.4.4.1-1: Summary of CPT Data

CPT Location Number	State Plane Coordinates Northing	State Plane Coordinates Easting	Ground Surface Elevation	Depth to Bedrock	Number of Attempts	Total Depth	Depth to Water
05193	747922.1	2082505.2	5993.7	16.7	1	18.9	0.5
05293	747710.3	2082848.8	5955.2	8.2	1	11.5	NE
05393	747701.8	2082753.1	5959.6	5.9	1	9.0	NE
05493	747669.3	2082654.3	5960.2	7.2	1	15.6	NE
05593	747593.6	2082506.6	5945.6	16.7	5	17.9	NE
05693	747596.5	2082436.0	5950.4	9.8	1	13.9	NE
05793	747623.5	2082351.0	5955.8	17.1	1	18.9	NE
05893	747618.3	2082251.4	5949.3	2.6	1	4.1	NE
05993	747586.8	2082153.1	5945.8	15.7	1	21.3	18.3
06093	747639.8	2082059.0	5959.9	20.0	1	23.6	4.4
06193	747654.1	2081953.3	5967.9	NE	3*	27.9	8.2
06293	747675.1	2081860.8	5968.7	22.0	1	24.9	NE
06939	747694.8	2081765.1	5971.5	17.1	1	21.3	NE
06493	747695.9	2081647.8	5979.1	21.3	2	22.9	NE
06593	747704.0	2081543.5	5982.4	13.1	1	19.4	NE
06693	747683.3	2081448.9	5991.3	16.4	2	18.0	NE
06793	747619.0	2081314.2	5983.3	2.0	1	3.3	NE
06893	747604.2	2081226.6	5990.7	10.8	1	13.1	6.1
06993	747596.2	2081148.1	5993.8	1.0	1	2.8	NE
07093	747705.2	2081063.8	6006.3	NE	1	9.8	PBNM
07193	747702.0	2080928.5	6022.0	NE	3*	11.3	4.7
07293	747700.7	2080862.5	6026.7	NE	3*	5.6	NE
07393	747699.4	2080727.9	6023.7	29.2	2	31.2	14.2

NOTES:
NE = not encountered
PBNM = preset but not measurable (static)
* = refusal before encountering bedrock

Table 2.4.4.2-1. Analysis Parameters, Sequence of Collection, and Order of Priority for Groundwater Samples

Parameter (in order of priority)	Minimum Volume
• Radiation Screening	6 oz (180 ml)
• HSL VOCs	2 - 40 ml
• Dissolved Uranium-233/234, Uranium-235, and Uranium-238	100 ml*
• Americium-241	1 L
• Plutonium-239/240	1 L
• Field Test Parameters:	
•• Ph, Conductivity, and Temperature	35 ml
• Dissolved Metals - CLP w/ Cs, Li, Sr, Sn, Mo, Si	1 L*
• BNA (Base Neutral Acid)	1 L (1000 ml)
• Pesticides / PCB	1 L
• Dissolved Gross Alpha and Gross Beta	550 ml*
• ^{3}H	100 ml
• TSS (Total Suspended Solids)	125 ml
• TOC (Total Organic Carbon)	125 ml
• COD (Chemical Oxygen Demand)	125 ml
• Orthophosphate (filtered)	250 ml*
• Nitrate / Nitrite as N	250 ml
• Dissolved Strontium-89/90	700 ml*
• Dissolved Radium-226/228	750 ml*
• TDS, Cl, F, SO_4, CO_3, HCO_3	1 L
• Cyanide	1 L
• Dissolved Cesium-137	2.5 L (2500 ml)*

* = On-site filtered sample (0.45-micrometer filter)

TABLE 2.4.4.2-2. Summary of IHSS 115 Well Point Information

Well Point Number	Sample Analysis					
	VOA	RADS	Metals	Pesticides and PCBs	SVOA	WQ
59893	NO SAMPLE, INSUFFICIENT WATER					
59993	YES	PARTIAL	NO SAMPLE, INSUFFICIENT WATER			
60093	YES	NO SAMPLE, INSUFFICIENT WATER				
60193	NO SAMPLE, DRY					
60293	YES	YES	YES	YES	YES	YES
60393	NO SAMPLE, DRY					
60493	YES	NO SAMPLE, INSUFFICIENT WATER				
60593	YES	NO SAMPLE, INSUFFICIENT WATER				
60693	YES	NO SAMPLE, INSUFFICIENT WATER				
60793	NO SAMPLE, DRY					
60893*	YES	YES	NO SAMPLE, INSUFFICIENT WATER			
60993*	NO SAMPLE, DRY					
61093*	YES	YES	YES	YES	YES	YES
62793**	YES	YES	NO SAMPLE, INSUFFICIENT WATER			
62893**	YES	YES	NO SAMPLE, INSUFFICIENT WATER			
63193***	YES	YES	YES	YES	YES	YES

Explanation:
*: Installed at soil gas anomaly as discussed in Section 2.4.3.3.
**: Installed as part of a seeps and springs study being conducted by EG&G.
***: Installed as replacement for monitoring well due to overhead powerlines (Section 2.4.4.3).
Note: Well points numbers 60993, 61093, and 63193 are constructed of 0.5-inch PVC.

Table 2.4.4.2-3a: Summary of Constituents Exceeding Background
IHSS 115 Stage 4 Well Points

Metals

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Manganese, Total	331.64		1	1	346.00	346.00	346.00	UG/L

Radionuclides

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Radium-226, Total	1.29		2	2	3.90	4.40	4.15	PCI/L
Strontium-89/90, Total	1.15		1	1	1.50	1.50	1.50	PCI/L

Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
ACETONE	10.00	1	1	45.00	45.00	45.00	UG/L

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.4.4.2-3b: Summary of Constituents Exceeding Background
IHSS 115 Stage 4 Soil Gas Wells

Metals

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Calcium, Total	128,816.15		1	1	416,000.00	416,000.00	416,000.00	UG/L
Lithium, Total	147.37		1	1	275.00	275.00	275.00	UG/L
Magnesium, Total	28,854.11		1	1	113,000.00	113,000.00	113,000.00	UG/L
Nickel, Total	32.68		1	1	101.00	101.00	101.00	UG/L
Strontium, Total	944.25		1	1	2,575.00	2,575.00	2,575.00	UG/L

Water Quality Parameters

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Orthophosphate	0.06		1	1	0.16	0.16	0.16	MG/L
Total Dissolved Solids	1,082.48		1	1	2,515.00	2,515.00	2,515.00	MG/L

Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
1,1,1-TRICHLOROETHANE	5.00	1	1	40.00	40.00	40.00	UG/L
1,1-DICHLOROETHENE	5.00	1	1	32.50	32.50	32.50	UG/L
1,2-DICHLOROETHENE	5.00	1	1	3.00	3.00	3.00	UG/L
TETRACHLOROETHENE	5.00	1	1	3.00	3.00	3.00	UG/L
TRICHLOROETHENE	5.00	1	1	150.00	150.00	150.00	UG/L

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.4.4.2-3c: Summary of Constituents Exceeding Background
IHSS 115 Stage 4 Seep/Spring Well Points

Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
1,1,1-TRICHLOROETHANE	5.00	2	1	2.00	2.50	2.25	UG/L
1,1-DICHLOROETHENE	5.00	2	1	2.50	4.00	3.25	UG/L
1,2-DICHLOROETHENE	5.00	2	1	2.50	4.00	3.25	UG/L
ACETONE	10.00	1	1	65.00	65.00	65.00	UG/L
TETRACHLOROETHENE	5.00	2	1	2.50	28.00	15.25	UG/L
TRICHLOROETHENE	5.00	2	1	2.50	7.00	4.75	UG/L

Table 2.4.4.3-1: Summary of Constituents Exceeding Background
IHSS 115 Stage 4 Monitoring Well Boreholes

Metals

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Chromium	76.30		26	1	4.40	77.30	13.62	MG/KG
Copper	42.43		26	2	2.50	6,920.00	283.18	MG/KG
Manganese	1,014.41		26	1	40.70	1,280.00	276.16	MG/KG
Nickel	69.05		26	2	7.50	91.70	21.25	MG/KG
Silver	34.39		25	1	1.00	36.00	2.91	MG/KG
Zinc	155.97		26	1	23.40	673.00	76.22	MG/KG

Radionuclides

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Plutonium-239/240	0.02		3	2	0.01	0.07	0.05	PCI/G

Pesticides/PCBs

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
AROCLOR-1254	160.00	19	1	80.00	630.00	108.95	UG/KG

Semi-Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
2-METHYLNAPHTHALENE	330.00	19	2	165.00	380.00	179.08	UG/KG
ACENAPHTHENE	330.00	19	3	165.00	1,200.00	256.84	UG/KG
ACENAPHTHYLENE	330.00	19	2	47.00	165.00	154.53	UG/KG
ANTHRACENE	330.00	19	3	165.00	1,800.00	363.68	UG/KG
BENZO(a)ANTHRACENE	330.00	19	3	165.00	3,700.00	528.95	UG/KG
BENZO(a)PYRENE	330.00	19	3	165.00	3,800.00	518.95	UG/KG
BENZO(b)FLUORANTHENE	330.00	19	3	165.00	4,500.00	602.63	UG/KG
BENZO(ghi)PERYLENE	330.00	19	3	165.00	1,500.00	290.26	UG/KG
BENZO(k)FLUORANTHENE	330.00	19	3	165.00	1,400.00	305.53	UG/KG
BENZOIC ACID	1,600.00	19	3	42.00	800.00	682.05	UG/KG
BIS(2-ETHYLHEXYL)PHTHALATE	330.00	19	3	55.00	165.00	148.21	UG/KG
BUTYL BENZYL PHTHALATE	330.00	19	1	165.00	360.00	175.26	UG/KG
CHRYSENE	330.00	19	3	165.00	3,800.00	522.89	UG/KG
DIBENZO(a,h)ANTHRACENE	330.00	19	3	165.00	590.00	195.39	UG/KG
DIBENZOFURAN	330.00	19	3	140.00	560.00	188.95	UG/KG
FLUORANTHENE	330.00	19	4	112.50	8,500.00	1,009.87	UG/KG
FLUORENE	330.00	19	3	165.00	1,100.00	274.74	UG/KG
INDENO(1,2,3-cd)PYRENE	330.00	19	3	165.00	2,000.00	319.21	UG/KG
NAPHTHALENE	330.00	19	2	165.00	860.00	215.39	UG/KG
PHENANTHRENE	330.00	19	4	107.50	7,000.00	959.61	UG/KG
PYRENE	330.00	19	4	104.00	6,600.00	830.47	UG/KG

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.4.4.3-1 (cont.): Summary of Constituents Exceeding Background
IHSS 115 Stage 4 Monitoring Well Boreholes

Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
2-BUTANONE	10.00	46	4	2.00	6.00	4.87	UG/KG
ACETONE	10.00	46	38	5.00	85.00	31.13	UG/KG
METHYLENE CHLORIDE	5.00	46	12	2.50	13.00	4.26	UG/KG
TETRACHLOROETHENE	5.00	46	2	1.00	2.50	2.46	UG/KG
TOLUENE	5.00	46	23	2.00	100.00	15.23	UG/KG
TRICHLOROETHENE	5.00	46	1	1.00	2.50	2.47	UG/KG

TABLE 2.4.4.3-2
IHSS 115 MONITORING WELL BOREHOLE SOIL SAMPLES
SEMI-VOLATILE CONSTITUENTS DETECTED BY SAMPLE

Location	Sample Number	Sample Type	Sample Depth (ft)	Sample Date	No. of Constituents Detected	Result Range (ug/kg) Min.	Max.
59493	BH50520AS	BH (Soil)	0.0-6.3	14-Jun-93	18	47	47
	BH50521AS	BH (Soil)	6.9-12.9	14-Jun-93	17	140	140
	BH50522AS	BH (Soil)	12.9-16.6	14-Jun-93	16	84	8500
59593	BH50552AS	BH (Soil)	0.0-5.0	15-Jun-93	5	104	424
	BH50553AS	BH (Soil)	6.0-11.0	15-Jun-93	3	42	360
61293	BH50505AS	BH (Soil)	6.0-10.6	12-Jun-93	2	55	68
63193	BH50617AS	BH (Soil)	6.0-12.0	22-Jun-93	1	165	
	BH50618AS	BH (Soil)	12.0-20.0	22-Jun-93	1	165	

15GWBSVE.WK1 - Sheet A

TABLE 2.4.4.3-3
IHSS 115 MONITORING WELL BOREHOLE SOIL SAMPLES
VOLATILE CONSTITUENTS DETECTED BY SAMPLE

Location	Sample Number	Sample Type	Sample Depth (ft)	Sample Date	Number of Constituents Detected	Result Range (ug/kg) Min.	Max.
59193	BH50463AS	BH	5.35-5.6	09-Jun-93	3	8	49
	BH50464AS	BH	7.75-8.0	09-Jun-93	3	8	42
59293	BH50450AS	BH	13.5-13.8	04-Jun-93	1	88	88
	BH50451AS	BH	18.2-18.5	04-Jun-93	1	100	100
59393	BH50465AS	BH	0.95-1.2	10-Jun-93	2	27	44
	BH50466AS	BH	2.75-3.0	10-Jun-93	3	9	56
	BH50467AS	BH	5.15-5.4	10-Jun-93	3	2	37
	BH50468AS	BH	7.75-8.0	10-Jun-93	2	2.5	27
59493	BH50524AS	BH	0.75-1.0	14-Jun-93	4	2	14
	BH50525AS	BH	6.05-6.3	14-Jun-93	5	1	52
	BH50526AS	BH	8.65-8.9	14-Jun-93	2	2.5	47
	BH50527AS	BH	12.65-12.9	14-Jun-93	3	2.5	4
	BH50528AS	BH	13.95-14.2	14-Jun-93	3	2.5	68
	BH50529AS	BH	16.35-16.6	14-Jun-93	2	9	22
59593	BH50540AS	BH	0.75-1.0	15-Jun-93	2	8	28
	BH50541AS	BH	4.75-5.0	15-Jun-93	2	9	22
	BH50542AS	BH	6.95-7.2	15-Jun-93	2	13	18
	BH50543AS	BH	9.35-9.6	15-Jun-93	3	2	41
	BH50544AS	BH	10.85-11.1	15-Jun-93	2	10	23
	BH50545AS	BH	15.95-16.2	15-Jun-93	2	9	23
59793	BH50488AS	BH	0.85-1.1	11-Jun-93	2	33	90
	BH50489AS	BH	2.95-3.2	11-Jun-93	3	2.5	34
	BH50490AS	BH	6.25-6.5	11-Jun-93	3	2.5	33
	BH50491AS	BH	8.45-8.7	11-Jun-93	4	2	39
	BH50492AS	BH	10.55-10.8	11-Jun-93	3	2.5	44
	BH50493AS	BH	15.05-15.3	11-Jun-93	3	2.5	21
61293	BH50508AS	BH	0.9-2.0	12-Jun-93	3	2	33
	BH50509AS	BH	3.35-3.6	12-Jun-93	2	9	33
	BH50510AS	BH	5.25-5.5	12-Jun-93	2	2.5	41
	BH50511AS	BH	7.05-7.3	12-Jun-93	2	2.5	49
63193	BH50620AS	BH	1.5-2.0	22-Jun-93	2	2.5	25
	BH50621AS	BH	3.5-4.0	22-Jun-93	3	2.5	19
	BH50622AS	BH	5.5-6.0	22-Jun-93	3	2.5	37
	BH50623AS	BH	7.5-8.0	22-Jun-93	3	2.5	85
	BH50624AS	BH	9.5-10.0	22-Jun-93	3	2.5	66
	BH50625AS	BH	11.5-12.0	22-Jun-93	2	8	34
	BH50626AS	BH	13.5-14.0	22-Jun-93	1	33	33
	BH50627AS	BH	15.5-16.0	22-Jun-93	2	2.5	33
	BH50628AS	BH	17.5-18.0	22-Jun-93	2	24	30
	BH50629AS	BH	19.5-20.0	22-Jun-93	2	3	20

Table 2.4.4.3-4: Summary of Constituents Exceeding Background
IHSS 115 Stage 4 Groundwater

Metals

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Aluminum, Total	12,642.33		4	2	100.00	262,000.00	80,422.50	UG/L
Barium, Total	208.14		4	3	152.00	3,040.00	1,212.75	UG/L
Beryllium, Total	4.80	4.80	4	1	1.90	20.30	7.05	UG/L
Calcium, Total	128,816.15		4	3	83,400.00	146,000.00	127,100.00	UG/L
Chromium, Total	22.58		4	2	5.00	354.00	103.90	UG/L
Cobalt, Total	39.40	39.40	4	1	13.60	120.00	47.57	UG/L
Copper, Total	39.12		4	2	12.50	326.00	136.85	UG/L
Iron, Total	14,654.53		4	3	50.00	294,000.00	99,612.50	UG/L
Lead, Total	11.75		4	3	1.20	240.00	89.55	UG/L
Lithium, Total	147.37		4	1	5.00	219.00	70.80	UG/L
Magnesium, Total	28,854.11		4	1	21,500.00	67,000.00	35,200.00	UG/L
Manganese, Total	331.64		4	3	14.00	5,480.00	3,233.50	UG/L
Mercury, Total	0.22		4	2	0.10	1.30	0.55	UG/L
Nickel, Total	32.68		4	2	14.50	288.00	98.18	UG/L
Potassium, Total	4,472.65		4	3	2,500.00	37,300.00	15,132.50	UG/L
Silicon, Total	48,399.65		4	2	7,130.00	354,000.00	114,832.50	UG/L
Silver, Total	10.00	10.00	4	1	2.50	16.30	7.20	UG/L
Strontium, Total	944.25		4	1	601.00	1,260.00	874.25	UG/L
Tin, Total	116.20		4	1	59.60	300.00	139.90	UG/L
Vanadium, Total	46.64		4	2	25.00	606.00	197.10	UG/L
Zinc, Total	153.21		4	2	2.90	982.00	368.72	UG/L

Radionuclides

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Amercium-241, Total	0.03		4	2	0.00	0.05	0.03	PCI/L
Plutonium-239/240, Total	0.06		4	2	0.01	0.17	0.08	PCI/L
Radium-226, Total	1.29		2	2	3.50	4.40	3.95	PCI/L

Semi-Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
ACENAPHTHENE	10.00	5	2	4.00	5.00	4.80	UG/L
BIS(2-ETHYLHEXYL)PHTHALATE	10.00	5	1	3.00	5.00	4.60	UG/L
DI-n-BUTYL PHTHALATE	10.00	5	1	2.00	5.00	4.40	UG/L
DIETHYL PHTHALATE	10.00	5	1	5.00	6.00	5.20	UG/L
FLUORANTHENE	10.00	5	2	3.00	5.00	4.40	UG/L
FLUORENE	10.00	5	2	3.00	5.00	4.40	UG/L
NAPHTHALENE	10.00	5	2	5.00	13.00	7.40	UG/L
PHENANTHRENE	10.00	5	2	5.00	6.00	5.20	UG/L
PYRENE	10.00	5	2	2.00	5.00	4.00	UG/L

Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
METHYLENE CHLORIDE	5.00	4	1	2.50	6.00	3.38	UG/L

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

TABLE 2.4.4.3-5
IHSS 115 MONITORING WELL GROUNDWATER SAMPLES
TAL METAL CONSTITUENTS DETECTED AT CONCENTRATIONS ABOVE BUTLS

Location	Sample Number	Sample Type	Sample QC Code	Sample Date	Chemical	Result (ug/L)	Detection Limit	BUTL (ug/L)	No BUTL (Max. Conc.)	Mean BUTL (ug/L)	Min. BUTL (ug/L)	Max. BUTL (ug/L)
59493	GW01024WC	GW	REAL	24-Jun-93	ALUMINUM	50000	18	12642.33		2742.8	22.6	19950
					NICKEL	60.1	11	32.68		10.58	1	71.6
					ZINC	348	3	153.21		37.16	4.2	498
					VANADIUM	115	3	46.64		13.81	1	123
					SILVER	16.3	5	10	*	2.35	1	10
					SILICON	79600	25	48399.65		15564.97	4399	51650
					POTASSIUM	13400	776	4472.65		1731.21	243	8370
					BARIUM	882	17	208.14		102.44	25.9	317
					MERCURY	1.3	0.2	0.22		0.12	0.1	0.27
					CHROMIUM	51.6	5	22.58		7.01	1	31.65
					CALCIUM	146000	149	128816.15		55030.23	15950	186000
					LEAD	86.4	1	11.75		3.26	0.5	25
					MANGANESE	5480	1	331.64		79.59	0.5	584
					COPPER	180	2	39.12		10.67	1	105
					IRON	71300	5	14654.53		3017.34	6.5	27100
59493	GW01166WC	GW	REAL	11-Aug-93	MANGANESE	4280	15	331.64		79.59	0.5	584
					LEAD	30.6	3	11.75		3.26	0.5	25
					IRON	33100	100	14654.53		3017.34	6.5	27100
					CALCIUM	137000	5000	128816.15		55030.23	15950	186000
					BARIUM	777	200	208.14		102.44	25.9	317
					POTASSIUM	7330	5000	4472.65		1731.21	243	8370
59593	GW01025WC	GW	REAL	24-Jun-93	TIN	300	18	116.2		33.88	4.7	100
					SILICON	354000	25	48399.65		15564.97	4399	51650
					ALUMINUM	262000	18	12642.33		2742.8	22.6	19950
					BARIUM	3040	17	208.14		102.44	25.9	317
					BERYLLIUM	20.3	1	4.8	*	1.07	0.4	4.8
					CALCIUM	142000	149	128816.15		55030.23	15950	186000
					CHROMIUM	354	5	22.58		7.01	1	31.65
					ZINC	982	3	153.21		37.16	4.2	498
					VANADIUM	606	3	46.64		13.81	1	123
					COPPER	326	2	39.12		10.67	1	105
					STRONTIUM	1260	1	944.25		312.61	58.1	1770
					IRON	294000	5	14654.53		3017.34	6.5	27100
					POTASSIUM	37300	776	4472.65		1731.21	243	8370
					NICKEL	288	11	32.68		10.58	1	71.6
					MERCURY	0.71	0.2	0.22		0.12	0.1	0.27
					MANGANESE	3160	1	331.64		79.59	0.5	584
					MAGNESIUM	67000	249	28854.11		10315.64	2230.25	47900
					LITHIUM	219	2	147.37		33.75	1.1	266
					LEAD	240	1	11.75		3.26	0.5	25
					COBALT	120	4	39.4	*	7.64	1	39.4

TABLE 2.4.4.3-6
IHSS 115 MONITORING WELL GROUNDWATER SAMPLES
DETECTED SEMI-VOLATILE AND TENTATIVELY IDENTIFIED SEMI-VOLATILE CONSTITUENTS

Location	Sample Number	Sample Type	Sample QC Code	Sample Date	Chemical	Result (ug/L)	Detection Limit
59493	GW01024WC	GW	REAL	24-Jun-93	NAPHTHALENE	13	10
					ACENAPHTHENE	4	10
					FLUORENE	3	10
					PHENANTHRENE	6	10
					DI-n-BUTYL PHTHALATE	2	10
					FLUORANTHENE	4	10
					PYRENE	3	10
					UNKNOWN	9.6	
59493	GW01166WC	GW	REAL	11-Aug-93	NAPHTHALENE	9	10
					ACENAPHTHENE	5	10
					FLUORENE	4	10
					PHENANTHRENE	5	10
					FLUORANTHENE	3	10
					PYRENE	2	10
					BIS(2-ETHYLHEXYL)PHTHALATE	3	10
59593	GW01167WC	GW	REAL	13-Aug-93	DIETHYL PHTHALATE	6	10

TABLE 2.4.4.3-7
SUMMARY OF IHSS 115 AQUIFER TEST ANALYSES

AREA/WELL	DATE	DATA TYPE	FILE-NAME(S)	ANALYSIS TYPE	INPUT REQUIRED	DATA INPUT	RESULTS
IHSS 115 Aquifer Tests							
PW59493	8/6/93	Hand		Step			
PW59493	8/18/93	Hand	—	—	—	—	—
OW63893	8/18/93	Hand	638-818	Unconfined Theis	- pumping rate - radius to OW - saturated thick.	0.027 ft3/min 3.8 ft. 11.25 ft.	T = 0.286 ft2/min S = 0.0002238 T = 0.2879 ft2/min S = 0.0002204
OW63893	8/18/93	Hand	638R-818	Recovery	- pumping rate - tot.time pump.	0.027 ft3/min 24.08 MIN	T = 0.2275 S' = 1.147
OW63993	8/18/93	Hand	—	—	—	—	—
OW64093	8/18/93	Hand	—	—	—	—	—
PW59493	8/25/93	Hand	594-825	Unconfined Theis Cooper-Jacob	- pumping rate - radius to OW - saturated thick.	0.068 ft3/min 0.083 ft. 7.91 ft.	T = 0.079 ft2/min S = 0.01645* T = 0.1078 ft2/min S = 0.0005952
PW59493	8/25/93	Transd.	594PODRW	Unconfined Theis Cooper-Jacob	- pumping rate - radius to OW - saturated thick.	0.068 ft3/min 0.083 ft. 7.91 ft.	T = 0.06703 ft2/min S = 0.1162* T = 0.1381 ft2/min S = 4.2 x 10-5
				Neuman			T = 0.02048 ft2/min S = 0.5689 Sy = 91.21 B = 0.03
							T = 0.02001 ft2/min S = 0.5689 Sy = 133.4 B = 0.03

TABLE 2.4.4.3-7, Continued.
SUMMARY OF IHSS 115 AQUIFER TEST ANALYSES

AREA/WELL	DATE	DATA TYPE	FILE-NAME(S)	ANALYSIS TYPE	INPUT REQUIRED	DATA INPUT	RESULTS
IHSS 115 Aquifer Tests							
PW59493	8/25/93	Transd.	594P1REC				
PW59493	8/25/93	Transd.	594P2REC	Recovery	- pumping rate - tot.time pump.	0.068 ft3/min 100 min.	T = 0.0492 ft2/min S = 1.197 x 10-32
OW63893	8/25/93	Hand	638-825	Unconfined Theis	- pumping rate - radius to OW - saturated thick.	0.068 ft3/min 3.8 ft. ft.	T = 0.1642 ft2/min S = 0.0008885
				Cooper-Jacob			T = 0.2066 S = 0.0002379
				Neuman			T = 0.04901 ft2/min S = 0.002089 Sy = 0.07987 B = 0.1
							T = 0.06134 ft2/min S = 0.002703 Sy = 0.019 B = 0.001
OW63893	8/25/93	Hand		Recovery	- pumping rate - tot.time pump.	0.068 ft3/min 100 min.	
OW63993	8/25/93	Hand	639-825	Unconfined Theis	- pumping rate - radius to OW - saturated thick.	0.068 ft3/min 6.1 ft. ft.	T = 0.2351 ft2/min S = 0.0008748
OW63993	8/25/93	Hand		Recovery	- pumping rate - tot.time pump.	0.068 ft3/min 100 min.	
OW64093	8/25/93	Hand	—	Unconfined Theis	- pumping rate - radius to OW - saturated thick.	0.068 ft3/min	T = 0.2122 ft2/min S = 0.01489

AREA/WELL	DATE	DATA TYPE	FILE-NAME(S)	ANALYSIS TYPE	INPUT REQUIRED	DATA INPUT	RESULTS
SLUG TEST (IHSS 115)							
PW59593	8/9/93	Transd.	595SL4	Slug Bouwer-Rice	- initial DD in well - rad. of casing - eff. rad. of well - saturated thick. - eff. well scr lth - stat ht of wat col. in well	2.57 ft. 0.083 ft. 0.42 ft. 3.03 ft. 3.03 ft. 3.03 ft.	K = 0.000138 ft/min Yo = 14.32 ft. K = 0.00000382 ft/mi Yo = 12.44 ft.
PW59593	8/9/93	Hand	595SL4	—	—	—	—
PW59593	8/9/93	Transd.	595SL2RE	Slug Bouwer-Rice	- initial DD in well - rad. of casing - eff. rad. of well - saturated thick. - eff. well scr lth - stat ht of wat col. in well	2.49 ft. 0.083 ft. 0.42 ft. 3.03 ft. 3.03 ft. 3.03 ft.	K = 0.0000303 ft/min Yo = 13.68 ft. K = 0.00078 ft/min Yo = 14.37 ft. K = 0.0000479 ft/min Yo = 12.98 ft.
PW59593	8/9/93	Transd.	59593SLG	—	—	—	—

Table 2.4.5.1-1
Area 400 Storm Sewer Inventory

	Segment ID [1]	Length (Ft)	Diameter (In) and Type [2]
1.	1 - 2	570	54 CMP
2.	2 - 3	268	36 CMP
3.	3 - 4	138	30 RCP
4.	4 - 4.2	90	24 RCP
5.	4.2 - 4.2.1	110	18 RCP
6.	4.2 - 4.2.2	241	24 RCP
7.	4.2.2 - 4.2.3	10	18 RCP
8.	4.2.3 - 4.3	348	18 RCP
9.	4.3 - 4.3.1	240	18 RCP
10.	4.3 - 4.4	160	18 RCP
11.	4 - 4.6	43	18 RCP
12.	4.6 - 4.5	163	18 RCP
13.	4 - 5	169	30 RCP
14.	5 - 5.1	60	15 RCP
15.	5 - 6	33	30 RCP
16.	6 - 6.1	79	21 RCP
17.	6.1 - 6.2	161	18 RCP
18.	6.2 - 6.3	175	18 RCP
19.	6.3 - 6.4	178	18 RCP
20.	6.4 - 6.5	167	15 RCP
21.	6 - 7	79	21 RCP
22.	7 - 8	44	21 RCP
23.	8 - 9	158	21 RCP
24.	9 - 9.1	18	24 RCP
25.	9.1 - 10	87	21 RCP
26.	10 - 11	235	15 RCP

1) See Figure 2.4.5.1-1 for schematic layout of storm sewer system.
2) RCP=Reinforced Concrete Pipe; CMP=Corrugated Metal Pipe

Table 2.4.6.3-1.
Results of Ambient Air Monitoring at Selected RAAMP Samplers Associated with OU5
(Results concurrent with available OU5 sampler results, October 1992-August 1993)

RAAMP Samplers	Radionuclide (μCi/ml) Plutonium-238	Plutonium-239
S-13		
(north of IHSS 115)		
Number of samples examined (n)	8	9
Sample average (x-bar)	1.25E-19	4.22E-18
Sample standard deviation (s)	3.54E-19	6.06E-18
S-14		
(north of IHSS 133)		
Number of samples examined (n)	8	9
Sample average (x-bar)	3.75E-19	2.78E-18
Sample standard deviation (s)	1.51E-18	6.51E-18
S-23		
(downwind of IHSS 115 and 133)		
Number of samples examined (n)	10	10
Sample average (x-bar)	0	3.7E-18
Sample standard deviation (s)	0	6.24E-18
S-32		
(upwind at west Plant boundary)		
Number of samples examined (n)	10	10
Sample average (x-bar)	8E-19	7E-19
Sample standard deviation (s)	1.55E-18	1.06E-18
S-38		
(downwind at east Plant boundary)		
Number of samples examined (n)	10	10
Sample average (x-bar)	8E-19	1.25E-17
Sample standard deviation (s)	9.19E-19	3.39E-17

Table 2.4.6.3-2. Results of Ambient Air Monitoring at OU5 (as of March 1, 1994)

	Radionuclide (μCi/ml)				
OU5 Air Samplers	Americium-241	Plutonium-239,240	Uranium-233,234	Uranium-235	Uranium-238
S102 sampler (upwind of OU5)					
Number of samples analyzed	12	12	12	12	12
Number of samples validated (%)	2 (17%)	2 (17%)	2 (17%)	2 (17%)	2 (17%)
Number of samples accepted	0	2	2	2	2
Number of samples unvalidated (%)	10 (83%)	10 (83%)	10 (83%)	10 (83%)	10 (83%)
Sample size (n)	10	12	12	12	12
Sample average (x-bar)	8.02E-18	2.63E-18	1.14E-16	8.57E-18	9.99E-17
Sample standard deviation (s)	7.47892E-18	3.5892E-18	1.02112E-16	1.49929E-17	7.44052E-17
S100 sampler (downwind of IHSS115 - Old Landfill)					
Number of samples analyzed	12	12	12	12	12
Number of samples validated (%)	2 (17%)	2 (17%)	2 (17%)	2 (17%)	2 (17%)
Number of samples accepted	0	2	2	2	2
Number of samples unvalidated (%)	10 (83%)	10 (83%)	10 (83%)	10 (83%)	10 (83%)
Sample size (n)	10	12	12	12	12
Sample average (x-bar)	1.96E-17	3.41E-17	3.87E-16	4.49E-18	3.12E-16
Sample standard deviation (s)	3.09843E-17	1.05201E-16	9.50036E-16	4.00364E-18	6.79786E-16
S101 sampler (downwind of IHSS133 - Ash Pits)					
Number of samples analyzed	12	12	12	12	12
Number of samples validated (%)	2 (17%)	2 (17%)	2 (17%)	2 (17%)	2 (17%)
Number of samples accepted	0	2	2	2	2
Number of samples unvalidated (%)	10 (83%)	10 (83%)	10 (83%)	10 (83%)	10 (83%)
Sample size (n)	10	12	12	12	12
Sample average (x-bar)	1.69E-17	1.88E-18	1.81E-16	5.64E-18	1.75E-16
Sample standard deviation (s)	2.13E-17	2.08E-18	3.03E-16	7.66E-18	2.98132E-16

Table 2.5.2.1-1
1992 Tripod -Mounted HPGe Survey Results
IHSS 133
Results Reported in pCi/g

SURVEY STATION	NORTH	EAST	K^{40}	Ra^{226}	Th^{232}	U^{238}	U^{235}	Cs^{137}
B12	748015	2079995	13.5	0.833	1.01	0	0.0573	0.152
B13	748015	2080145	9.65	0.91	1.28	2.42	0.0936	0.619
B14	748015	2080295	10	0.78	1.36	2.05	0.0607	0.476
B15	748015	2080445	12.7	1.24	1.04	0	0.0283	0.409
B15	748015	2080445	7.34	0.698	1.12	1.48	0.0895	0.36
B16	748015	2080595	15.9	0.649	0.975	1.91	0.0548	0.342
B17	748015	2080745	7.57	0.678	1.03	1.8	0.0428	0.746
B18	748015	2080895	8.95	1.31	0.971	1.23	0.0345	0.645
C7	747865	2079245	14.3	1	0.964	2.02	0.0438	0.136
C8	747865	2079395	12.5	1.46	1.13	1.96	0.0272	0.281
C9	747865	2079545	8.53	0.96	1.01	1.72	0.0647	0.247
C10	747865	2079695	8.03	0.85	1.21	1.7	0.0668	0.514
C11	747865	2079845	8.39	0.842	1.25	2.46	0.0721	0.563
C12	747865	2079995	7.28	1.08	1.07	1.41	0.0214	0.333
C12	747865	2079995	6.93	0.712	1.01	1.4	0.0646	0.357
C13	747865	2080145	9.36	0.867	1.39	2.28	0.0791	0.811
C14	747865	2080295	6.23	1.77	1.13	1.31	0.000618	0.938
C15	747865	2080445	7.46	0.817	1.25	2.11	0.0731	0.608
C16	747865	2080595	4.49	0.642	0.852	1.38	0.0372	0.719
C17	747865	2080745	5.62	0.721	1.03	1.52	0.0367	0.829
C18	747865	2080895	5.44	0.706	0.976	1.55	0.0655	0.678
D3	747715	2078645	6.37	1.61	0.841	1.68	0	0.387
D4	747715	2078795	6.97	1.19	0.977	1.56	0.021	0.411

Table 2.5.2.1-1
1992 Tripod -Mounted HPGe Survey Results
IHSS 133
Results Reported in pCi/g

SURVEY STATION	NORTH	EAST	K^{40}	Ra^{226}	Th^{232}	U^{238}	U^{235}	Cs^{137}
D5	747715	2078945	6.69	0.835	0.961	1.82	0.0387	0.751
D5	747715	2078945	6.7	0.81	0.96	2.23	0.04	0.75
D6	747715	2079045	14.5	0.969	1.49	2.2	0.0884	0.436
D7	747715	2079245	6.7	0.728	1.05	1.45	0.0609	0.439
D8	747715	2079395	20.9	0.928	.957	1.63	0.0443	0.0515
D9	747715	2079545	10.4	0.926	1.22	1.48	0.0164	0.203
D10	747715	2079695	14.6	1.33	1.64	2.57	0.0433	0.336
D11	747715	2079845	9.48	1.18	1.23	1.88	0.0494	0.221
D12	747715	2079995	9.89	1.07	1.05	1.24	0.0208	0.242
D13	747715	2080145	6.54	1.48	1.14	1.79	0.0316	0.683
D14	747715	2080295	6.91	1.27	1.04	1.41	0.0303	0.615
D15	747715	2080445	14	1.23	1.62	1.77	0.0304	0.389
D16	747715	2080595	12.5	1.08	1.5	2.29	0.068	0.42
D17	747715	2080745	12.8	1.57	1.75	2.23	0.0632	0.489
D18	747715	2080890	10	0.9	1.3	0	0	0.5
E1	747565	2078345	8.01	1.16	1.18	1.75	0.0173	0.346
E2	747565	2078495	15.6	1.15	2.00	1.72	0.119	0.518
E3	747565	2078645	6.52	1.09	0.904	0.77	0.0918	0.265
E4	747565	2078795	11.6	1.29	1.15	1.69	0.0408	0.138
E5	747565	2078945	12.2	1.59	1.39	1.57	0	0.259
E6	747565	2079095	18.4	1.7	1.99	2.54	0.055	0.383
E7	747565	2079245	16.3	1.56	2.07	2.85	0.0635	0.452
E8	747565	2079395	9.63	1.03	1.43	2.8	0.0974	0.455
E9	747565	2079545	10.4	1.1	1.54	2.99	0.105	0.484

Table 2.5.2.1-1
1992 Tripod -Mounted HPGe Survey Results
IHSS 133
Results Reported in pCi/g

SURVEY STATION	NORTH	EAST	K^{40}	Ra^{226}	Th^{232}	U^{238}	U^{235}	Cs^{137}
E10	747565	2079695	11.1	1.22	1.69	3.33	0.0875	0.379
E11	747565	2079845	15.9	1.4	2.23	3.86	0.161	0.454
E12	747565	2079995	15.3	1.3	2.25	3.69	0.112	0.543
E13	747565	2080145	8.88	1.04	1.36	2.14	0.0708	0.375
E14	747565	2080295	10.3	1.27	1.3	2.41	0.0478	0.392
E15	747565	2080445	17.6	1.68	2.38	2.9	0.074	0.504
E16	747565	2080595	14.5	1.12	1.91	2.15	0.109	0.385
E17	747565	2080745	14.2	1.22	1.84	2.02	0.0669	0.55
E18	747565	2080895	9.22	1.12	1.34	1.94	0.0489	0.456
F1	747415	2078345	15.3	1.52	2.69	2.2	0.0692	0.489
F2	747415	2078495	13.8	1.41	2.23	2.72	0.0686	0.36
F3	747415	2078645	12.3	1.03	1.98	2.44	0.148	0.426
F4	747415	2078795	13.5	1.01	1.77	1.52	0.108	0.453
F5	747415	2078945	15.4	1.88	2.2	2.5	0.0606	0.445
F6	747415	2079095	23.6	1.79	1.74	2.55	0.0839	0.284
F7	747415	2079245	8.67	0.943	1.33	2.62	0.0949	0.413
F8	747415	2079395	15.4	1.32	2.22	7.55	0.19	0.327
F9	747415	2079545	10.1	1.08	1.54	2.37	0.0831	0.307
F10	747415	2079695	9.41	1.2	1.49	21.7	0.375	0.484
F11	747415	2079845	8.24	1.04	1.26	3.23	0.0683	0.426
F12	747415	2079995	10.9	1.06	1.5	2.84	0.0727	0.41
F13	747415	2080145	12.9	1.33	2.13	3.77	0.106	0.5
F14	747415	2080295	9.19	1.67	1.51	2.49	0.0442	0.416
F15	747415	2080445	13.4	1.9	1.98	2.31	.0322	0.489

Table 2.5.2.1-1
1992 Tripod -Mounted HPGe Survey Results
IHSS 133
Results Reported in pCi/g

SURVEY STATION	NORTH	EAST	K^{40}	Ra^{226}	Th^{232}	U^{238}	U^{235}	Cs^{137}
F16	747415	2080595	10.4	0.827	1.32	1.43	0.0582	0.409
F17	747415	2080745	12.6	1.5	1.93	1.6	0.0495	0.527
F18	747415	2080895	13.1	1.15	1.68	2.54	0.0785	0.538
G1	747265	2078345	14.6	1.45	2	2.18	0.0604	0.399
G2	747265	2078495	13	1.4	2.24	2.44	0.114	0.421
G3	747265	2078645	9.02	0.809	1.35	1.84	0.0334	0.332
G4	747265	2078795	13.7	1.12	2.14	2.65	0.153	0.469
G7	747265	2079245	13.2	1.73	2.18	2.98	0.0408	0.403
G8	747265	2079395	9.03	0.966	1.36	2.68	0.0957	0.423
G9	747265	2079545	8.57	0.927	1.22	1.76	0.0387	0.323
G11	747265	2079845	11.8	1.07	1.87	2.85	0.0788	0.326
G12	747265	2079995	13.8	1.27	2.1	2.38	0.0812	0.428
G13	747265	2080145	15.9	1.45	2.29	4	0.154	0.521
G14	747265	2080295	10.7	1.57	1.65	2.1	0.0211	0.444
G15	747265	2080445	12.1	1.82	1.97	1.88	0.0469	0.467
G16	747265	2080595	13	1.07	1.83	2.8	0.08	0.41
G17	747265	2080745	12.5	1.51	1.67	1.71	0.0561	0.456
G18	747265	2080895	15.3	1.07	1.02	2.11	0.0436	0.146
H13	747115	2080145	13.3	1.13	1.9	2.54	0.0711	0.592
H14	747115	2080295	8.67	1.21	1.42	2.03	0.0666	0.457
H15	747115	2080445	16.3	1.48	2.03	2.48	0.0731	0.385
H16	747115	2080595	16	1.17	2.13	2.36	0.118	0.517
H17	747115	2080745	11.8	0.925	1.61	1.78	0.104	0.413

Table 2.5.2.1-2
1993 Truck -Mounted HPGe Survey Results
IHSS 133
Results Reported in pCi/g

SURVEY STATION	NORTH	EAST	K^{40}	Ra^{226}	Th^{232}	U^{238}	U^{235}	Cs^{137}
B12	748015	2079995	12	1.16	0.914	1.38	0.0594	0.152
B13	748015	2080145	8.52	0.8	1.03	1.47	0.06	0.367
B14	748015	2080295	8.23	0.779	0.955	1.23	0.0379	0.353
B14	748015	2080295	8.95	0.993	0.957	1.17	0.0572	0.32
B15	748015	2080445	11.6	0.816	0.909	1.12	0.0606	0.335
B16	748015	2080595	11.3	0.606	0.76	1.49	0.0439	0.266
B17	748015	2080745	10.1	0.626	0.743	1.52	0.395	0.336
B18	748015	2080895	8.29	0.687	0.836	1.25	0.0377	0.454
C7	747865	2079245	10.2	0.626	0.693	1.27	0.0497	0.112
C8	747865	2079395	11.5	0.908	1.01	1.65	0.0744	0.166
C9	747865	2079545	7.83	0.673	0.717	1.61	0.0704	0.181
C10	747865	2079695	8.88	1	1.1	1.59	0.0489	0.432
C11	747865	2079845	8.17	0.996	1.05	1.43	0.0819	0.426
C12	747865	2079995	7.16	0.874	0.974	1.23	0.0748	0.302
C13	747865	2080145	8.33	0.874	1.18	1.57	0.0629	0.597
C14	747865	2080295	5.95	0.743	0.944	1.36	0.0403	0.625
C15	747865	2080445	6.54	8.28	0.976	1.26	0.0353	0.501
C16	747865	2080595	5.29	0.801	0.87	1.23	0.0471	0.541
C17	747865	2080745	4.3	0.556	0.605	1.25	0.0272	0.378
C18	747865	2080895	6.68	0.686	0.738	1.05	0.0432	0.388
D3	747415	2078645	7.67	0.93	0.794	1.5	0.0465	0.293
D4	747415	2078795	8.3	0.997	0.999	1.21	0.062	0.379
D5	747715	2078945	7.57	0.751	0.931	1.21	0.0764	0.48
D6	747715	2079095	11.1	0.681	1.05	1.22	0.581	0.287

Table 2.5.2.1-2
1993 Truck -Mounted HPGe Survey Results
IHSS 133
Results Reported in pCi/g

SURVEY STATION	NORTH	EAST	K^{40}	Ra^{226}	Th^{232}	U^{238}	U^{235}	Cs^{137}
D7	747715	2079245	13.7	0.795	1.12	1.54	0.0574	0.178
D8	747715	2079395	15	0.766	1.08	1.8	0.0619	0.108
D9	747715	2079545	9.39	0.743	1.06	2.3	0.0778	0.24
D10	747715	2079695	10.8	0.765	1.21	1.98	0.0735	0.278
D11	747715	2079845	9.18	0.699	1.02	1.53	0.074	0.267
D12	747715	2079995	9.42	0.751	0.997	1.55	0.063	0.28
D13	747715	2080145	6.42	0.738	0.904	1.53	0.0605	0.469
D14	747715	2080295	9.01	0.734	1.17	1.7	0.0748	0.462
D15	747715	2080445	12.5	0.853	1.43	1.61	0.0986	0.331
D16	747715	2080595	12.6	1.03	1.36	1.52	0.0903	0.317
D17	747715	2080745	10.2	1.02	1.18	1.92	0.0549	0.372
D18	747715	2080895	10.7	0.901	1.21	1.58	0.0645	0.356
E1	747565	2078345	6.51	0.755	0.894	1.03	0.0506	0.247
E2	747565	2078495	6.31	0.709	0.966	1.35	0.0581	0.421
E3	747565	2078645	6.01	0.696	0.931	1.18	0.0687	0.511
E4	747565	2078795	10.8	0.876	1.05	1.1	0.0417	0.198
E5	747565	2078945	10.8	0.892	1.14	1.41	0.054	0.222
E6	747565	2079095	15.9	0.987	1.69	1.95	0.0843	0.332
E6	747565	2079095	15.4	1.01	1.64	1.76	0.0914	0.315
E7	747565	2079245	14.8	0.916	1.55	2.12	0.101	0.281
E8	747565	2079395	15.1	1.03	1.6	2.18	0.11	0.279
E9	747565	2079545	9.41	0.726	1.14	3.36	0.121	0.333
E10	747565	2079695	11.7	0.944	1.62	3.9	0.138	0.31
E11	747565	2079845	13.5	1.02	1.84	3.65	0.16	0.333
E12	747565	2079995	12.7	0.906	1.75	3.51	0.152	0.402

Table 2.5.2.1-2
1993 Truck -Mounted HPGe Survey Results
IHSS 133
Results Reported in pCi/g

SURVEY STATION	NORTH	EAST	K^{40}	Ra^{226}	Th^{232}	U^{238}	U^{235}	Cs^{137}
E13	747565	2080145	9.59	0.812	1.31	1.85	0.0895	0.363
E14	747565	2080295	11.1	0.832	1.39	1.94	0.0812	0.425
E15	747565	2080445	14.6	1.02	1.86	2.46	0.114	0.355
E16	747565	2080595	13	1.14	1.57	1.67	0.0987	0.36
E17	747565	2080745	11.5	1.08	1.43	1.91	0.0869	0.363
E18	747565	2080895	9.12	0.851	1.1	1.4	0.0452	0.349
F1	747415	2078345	13.3	1.14	2.26	2.05	0.108	0.377
F2	747415	2078495	13	1.08	2.02	2	0.0938	0.367
F3	747415	2078645	13	0.979	2	1.59	0.12	0.405
F4	747415	2078795	12.4	0.878	1.67	1.48	0.0995	0.396
F5	747415	2078954	14.2	1	1.92	1.87	0.102	0.395
F6	747415	2079095	18.7	1.24	1.63	2.02	0.11	0.281
F7	747415	2079245	15	1.06	2.03	2.34	0.107	0.39
F8	747415	2079395	13.1	0.894	1.74	2.61	0.095	0.316
F9	747415	2079545	9.92	0.786	1.38	2.75	0.118	0.344
F10	747415	2079695	10	0.803	1.54	18.8	0.363	0.41
F11	747415	2079845	9.36	0.842	1.36	2.75	0.109	0.379
F12	747415	2079995	10.8	0.835	1.43	2.81	0.118	0.367
F13	747415	2080145	15.1	1.19	2.32	3.57	0.163	0.528
F14	747415	2080295	10.2	0.826	1.47	2.13	0.0864	0.404
F15	747415	2080445	13.2	1.01	1.81	2.27	0.112	0.424
F16	747415	2080595	11.4	1.11	1.38	1.82	0.0985	0.398
F17	747415	2080745	10.7	1.09	1.38	1.63	0.0653	0.378
F18	747415	2080895	10.8	0.925	1.28	1.73	0.0765	0.391
G1	747265	2078345	12.1	0.9	1.69	2.02	0.099	0.356

Table 2.5.2.1-2
1993 Truck -Mounted HPGe Survey Results
IHSS 133
Results Reported in pCi/g

SURVEY STATION	NORTH	EAST	K^{40}	Ra^{226}	Th^{232}	U^{238}	U^{235}	Cs^{137}
G2	747265	2078495	12.9	0.993	2	1.76	0.12	0.384
G2	747265	2078495	12.9	1.05	2.02	2.12	0.09	0.371
G3	747265	2078645	10.6	1.2	1.76	1.76	0.0861	0.396
G4	747265	2078795	12.3	1.31	1.89	1.75	0.0718	0.383
G7	747265	2079245	11.3	0.834	1.54	1.76	0.0913	0.321
G8	747265	2079395	11.8	1.23	1.68	1.71	0.0798	0.361
G9	747265	2079545	9.66	1.12	1.44	2.28	0.0573	0.373
G11	747265	2079845	10.9	0.863	1.51	1.89	0.0909	0.332
G12	747265	2079995	12.6	0.986	1.82	2.18	0.0892	0.371
G13	747265	2080145	15.1	1.12	2.13	3.59	0.166	0.486
G14	747265	2080295	11.6	0.857	1.62	1.48	0.0858	0.402
G15	747265	2080445	11.6	0.949	1.71	1.91	0.0919	0.397
G16	747265	2080595	11.5	1.21	1.59	1.67	0.078	0.375
G17	747265	2080745	10.9	1.14	1.33	1.84	0.0829	0.359
G18	747265	2080895	11.1	1.01	1.56	1.68	0.0628	0.343
H13	747115	2080145	11.4	0.794	1.51	1.85	0.115	0.429
H14	747115	2080295	15.3	1.29	2.21	2.59	0.11	0.596
H15	747115	2080445	14.9	1.14	1.83	2.1	0.0883	0.373
H16	747115	2080595	13	1.13	1.73	1.76	0.0904	0.393
H17	747115	2080745	10.8	0.965	1.42	1.71	0.0709	0.328

Table 2.5.3.1-1a: Summary of Constituents Exceeding Background
IHSS 133 Stage 3 Surface Soils

Metals

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Silver	5.00	5.00	18	1	1.00	6.30	1.29	MG/KG
Zinc	97.20		18	1	28.80	157.00	57.44	MG/KG

Radionuclides

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Gross Alpha	42.22		17	1	13.50	48.00	27.25	PCI/G
Uranium-233/234	1.76		17	7	0.81	3.30	1.85	PCI/G
Uranium-238	1.90		17	14	1.30	5.20	2.62	PCI/G

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.5.3.1-1b: Summary of Constituents Exceeding Background
IHSS 133 Stage 3 Seep/Spring Sediments

Metals

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Antimony	41.04		2	1	35.20	43.60	39.40	MG/KG
Zinc	143.00		2	2	294.00	1,050.00	672.00	MG/KG

Radionuclides

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Uranium-238	2.52		2	1	2.40	3.70	3.05	PCI/G

Semi-Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
BIS(2-ETHYLHEXYL)PHTHALATE	330.00	2	1	80.00	165.00	122.50	UG/KG

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

TABLE 2.5.3.2-1

DRILLING SUMMARY FOR IHSS 133 BOREHOLES

Borehole Identification	Borehole Location (IHSS)	Total Depth (Feet)	Surface Elevation (Feet)	Depth To Bedrock (feet)	Bedrock Encountered	Depth To Groundwater (feet)	Depth of Ash/ Waste Material (feet)
56193	133.1	34.0	6074.8	28	claystone	5.0	
56893	133.2	24.3	6027.4	18.2	claystone		2.4 - 7.7
56993	133.2	32.3	6025.0	26.3	claystone	12-14 & 22.0	8.1 - 8.7
57093	133.2	37.1	6023.8	34.1	clayey sandstone	14.6	
57193	133.2	18.5	6018.2	12.5	claystone		
57293	133.2	30.9	6016.5	26.9	claystone		
57293a	133.2	12.0	6016.4	--			
57293b	133.2	12.0	6016.8	--			
57293c	133.2	12.0	6015.8	--			
57393	133.2	30.2	6014.2	24.8	claystone	unknown*	
56293	133.1	14.0	6035.5	6.3	claystone		
56393	133.1	12.0	6032.7	6.9	claystone		0 - 6.9
56393a	133.1	12.0	6032.2	5.0	silty claystone		
56393b	133.1	12.0	6030.8	3.0	silty claystone		
56393c	133.1	5.0	6032.6	--		0.5	3.0 - 5.0
56493	133.1	10.0	6032.5	4.6	claystone		
56593	133.3	19.0	6030.4	13.6	claystone		
56693	133.3	9.0	6027.0	2.5	claystone		
56693a	133.3	4.0	6026.1	2.0	claystone		
56693b	133.3	4.0	6025.1	2.0	claystone		
56693c	133.3	4.0	6026.8	2.0	claystone		
56793	133.3	18.0	6022.4	10.9	claystone		
55593	133.4	30.0	6032.2	24.0	claystone		
55693	133.4	29.0	6033.9	23.0	claystone		15.5
55693a	133.4	18.0	6033.9	--			
55793	133.4	25.9	6035.0	20.4	claystone		
55793a	133.4	12.0	6034.7	--			5.0 - 7.0
55793b	133.4	12.0	6034.7	--			
55793c	133.4	12.0	6034.5	--			
55793d	133.4	12.0	6035.6	--			
55893	133.4	8.0	6037.9	4.2	clayey siltstone		
55993	133.4	21.0	6037.8	14.3	claystone		2.3 - 11.0
56093	133.4	16.0	6037.8	8.9	claystone		
56093a	133.4	12.0	6038.1	--			
56093b	133.4	12.0	6037.9	--			
56093c	133.4	12.0	6037.8	10.0	claystone		
55193	133.5	12.0	6047.5	6.0	claystone		
55293	133.5	14.0	6048.6	8.0	silty claystone		
55393	133.5	33.3	6081.6	27.0	claystone		15.9 - 17.5
55493	133.5	36.2	6081.6	32.8	claystone		
54893	133.6	15.0	6030.5	9.3	claystone		
54993	133.6	14.0	6024.6	8.2	silty claystone		
55093	133.6	14.5	6020.7	8.6	claystone	5.0	
57493	P&D area	30.4	6030.4	18.6	sandy claystone	16.0	
57593	P&D area	18.0	6025.7	11.7	sandy claystone		

TABLE 2.5.3.2-1

DRILLING SUMMARY FOR IHSS 133 BOREHOLES

Borehole Identification	Borehole Location (IHSS)	Total Depth (Feet)	Surface Elevation (Feet)	Depth To Bedrock (feet)	Bedrock Encountered	Depth To Groundwater (feet)	Depth of Ash/ Waste Material (feet)
58093	HPGe Anom.	16.0	6035.8	10.0	silty claystone	7.0	0 - 10.0
58093a	HPGe Anom.	5.0	6035.8	--			0 - 5.0

* Water not detected until abandonment procedures took place assumed water from gravel layer just above bedrock

Table 2.5.3.2-2: Summary of Constituents Exceeding Background
IHSS 133 Stage 3 Hydropunch

Metals

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Aluminum, Total	12,642.33		4	2	4,540.00	172,000.00	56,535.00	UG/L
Barium, Total	208.14		4	3	133.00	917.00	434.50	UG/L
Beryllium, Total	4.80	4.80	4	2	1.70	9.80	5.30	UG/L
Cadmium, Total	11.10	11.10	4	1	0.50	67.40	19.40	UG/L
Chromium, Total	22.58		4	3	19.60	198.00	78.05	UG/L
Cobalt, Total	39.40	39.40	4	1	5.60	71.60	25.42	UG/L
Copper, Total	39.12		4	3	36.70	1,580.00	522.68	UG/L
Iron, Total	14,654.53		4	3	9,890.00	195,000.00	64,822.50	UG/L
Lead, Total	11.75		2	2	20.90	68.40	44.65	UG/L
Magnesium, Total	28,854.11		4	1	17,300.00	39,400.00	28,375.00	UG/L
Manganese, Total	331.64		4	2	209.00	1,140.00	575.25	UG/L
Mercury, Total	0.22		4	1	0.10	0.29	0.15	UG/L
Nickel, Total	32.68		4	3	23.00	138.00	63.80	UG/L
Potassium, Total	4,472.65		4	4	5,560.00	25,100.00	11,310.00	UG/L
Silver, Total	10.00	10.00	4	2	1.00	238.00	68.05	UG/L
Vanadium, Total	46.64		4	2	14.00	259.00	90.17	UG/L
Zinc, Total	153.21		3	3	326.00	1,540.00	772.67	UG/L

Radionuclides

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Amercium-241, Total	0.03		3	2	0.01	2.32	0.81	PCI/L
Gross Alpha, Total	390.58		4	2	26.68	3,038.00	1,415.67	PCI/L
Gross Beta, Total	221.31		4	3	38.47	2,899.00	1,235.12	PCI/L
Plutonium-239/240, Total	0.06		4	3	-0.00	2.31	0.85	PCI/L
Radium-226, Total	1.29		1	1	7.40	7.40	7.40	PCI/L
Uranium-233/234, Total	144.83		4	2	3.96	620.70	220.94	PCI/L
Uranium-235, Total	5.23		4	2	0.29	50.94	19.22	PCI/L
Uranium-238, Total	114.17		4	2	4.01	2,728.00	1,239.75	PCI/L

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.5.3.2-3: Summary of Constituents Exceeding Background
IHSS 133 Stage 3 Characterization Boreholes

Metals

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Antimony	47.00	47.00	107	2	6.00	149.00	8.73	MG/KG
Arsenic	14.66		97	1	1.00	17.30	3.44	MG/KG
Barium	321.20		107	7	26.60	683.00	144.45	MG/KG
Beryllium	15.75		107	1	0.28	131.00	2.23	MG/KG
Cadmium	2.17		107	7	0.50	56.90	2.48	MG/KG
Chromium	76.30		107	2	2.70	8,310.00	93.03	MG/KG
Cobalt	32.60		107	3	2.10	67.60	9.85	MG/KG
Copper	42.43		107	10	3.60	2,920.00	85.85	MG/KG
Iron	45,421.42		104	1	2,340.00	52,100.00	15,271.73	MG/KG
Manganese	1,014.41		107	4	26.40	1,260.00	278.64	MG/KG
Molybdenum	67.60	67.60	107	1	0.90	129.00	20.44	MG/KG
Nickel	69.05		107	3	3.60	4,750.00	60.64	MG/KG
Potassium	7,002.88		107	1	327.00	7,040.00	1,397.07	MG/KG
Silver	34.39		88	6	1.00	311.00	11.25	MG/KG
Tin	323.37		107	1	2.40	579.00	26.68	MG/KG
Zinc	155.97		107	6	7.60	2,390.00	120.09	MG/KG

Radionuclides

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Americium-241	0.02		104	10	-0.00	0.61	0.02	PCI/G
Gross Alpha	49.48		110	7	6.43	742.00	36.79	PCI/G
Gross Beta	40.75		111	11	16.94	1,580.00	62.93	PCI/G
Plutonium-239/240	0.02		97	12	-0.00	0.94	0.05	PCI/G
Uranium-233/234	3.25		110	9	0.35	126.00	6.62	PCI/G
Uranium-235	0.14		110	14	0.00	37.68	0.91	PCI/G
Uranium-238	1.73		110	27	0.51	1,160.00	32.47	PCI/G

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.5.3.3-1: Summary of Constituents Exceeding Background
IHSS 133 Stage 3 Magnetic Anomaly Boreholes

Metals

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Barium	321.20		10	1	132.00	392.00	216.00	MG/KG
Nickel	69.05		10	1	22.10	72.00	34.84	MG/KG

Radionuclides

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Plutonium-239/240	0.02		3	2	0.01	0.08	0.03	PCI/G

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.5.4.1-1: Summary of Constituents Exceeding Background
IHSS 133 Stage 4 Monitoring Well Boreholes

Metals

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Antimony	47.00	47.00	25	1	6.00	51.50	13.22	MG/KG
Barium	321.20		30	2	72.30	374.00	152.26	MG/KG
Zinc	155.97		30	1	17.80	187.65	50.77	MG/KG

Radionuclides

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Plutonium-239/240	0.02		10	3	0.00	0.07	0.02	PCI/G

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.5.4.1-2: Summary of Constituents Exceeding Background
IHSS 133 Stage 4 Groundwater

Metals

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Aluminum, Total	12,642.33		2	2	64,200.00	357,000.00	210,600.00	UG/L
Barium, Total	208.14		2	2	545.00	2,650.00	1,597.50	UG/L
Beryllium, Total	4.80	4.80	2	2	5.00	29.40	17.20	UG/L
Chromium, Total	22.58		2	2	68.60	442.00	255.30	UG/L
Cobalt, Total	39.40	39.40	2	1	24.00	161.00	92.50	UG/L
Copper, Total	39.12		2	2	39.30	301.00	170.15	UG/L
Iron, Total	14,654.53		2	2	65,900.00	418,000.00	241,950.00	UG/L
Lead, Total	11.75		2	2	23.90	113.00	68.45	UG/L
Lithium, Total	147.37		2	1	51.30	306.00	178.65	UG/L
Magnesium, Total	28,854.11		2	1	22,000.00	79,800.00	50,900.00	UG/L
Manganese, Dissolved	184.57		2	2	480.00	515.00	497.50	UG/L
Manganese, Total	331.64		2	2	910.00	3,520.00	2,215.00	UG/L
Mercury, Total	0.22		2	1	0.10	0.24	0.17	UG/L
Nickel, Total	32.68		2	2	42.40	313.00	177.70	UG/L
Potassium, Total	4,472.65		2	2	9,110.00	49,700.00	29,405.00	UG/L
Silicon, Total	48,399.65		2	2	112,000.00	205,000.00	158,500.00	UG/L
Strontium, Total	944.25		2	1	451.00	1,080.00	765.50	UG/L
Vanadium, Total	46.64		2	2	114.00	674.00	394.00	UG/L
Zinc, Total	153.21		2	1	113.00	602.00	357.50	UG/L

Radionuclides

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Amercium-241, Total	0.03		2	1	0.02	0.06	0.04	PCI/L
Radium-226, Total	1.29		2	2	1.40	3.90	2.65	PCI/L

Water Quality Parameters

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Chloride	42.37		2	2	54.00	64.00	59.00	MG/L
Total Suspended Solids	1,133.72		2	2	8,000.00	12,000.00	10,000.00	MG/L

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

TABLE 2.5.4.1-3
IHSS 133 MONITORING WELL GROUNDWATER SAMPLES
TAL METAL CONSTITUENTS DETECTED AT CONCENTRATIONS ABOVE BUTLS

Location	Sample Number	Sample Type	Sample QC Code	Sample Date	Chemical	Result (ug/L)	Detection Limit	BUTL (ug/L)	No BUTL (Max. Conc.)	Mean BUTL (ug/L)	Min. BUTL (ug/L)	Max. BUTL (ug/L)
58793	GW01017W	GW	REAL	18-Jun-93	STRONTIUM	1080	200	944.25		312.61	58.1	1770
					LITHIUM	306	100	147.37		33.75	1.1	266
					SILICON	205000	100	48399.7		15564.97	4399	51650
					MANGANESE	3520	15	331.64		79.59	0.5	584
					MERCURY	0.24	0.2	0.22		0.12	0.1	0.27
					NICKEL	313	40	32.68		10.58	1	71.6
					POTASSIUM	49700	5000	4472.65		1731.21	243	8370
					VANADIUM	674	50	46.64		13.81	1	123
					ZINC	602	20	153.21		37.16	4.2	498
					BARIUM	2650	200	208.14		102.44	25.9	317
					BERYLLIUM	29.4	5	4.8	*	1.07	0.4	4.8
					CHROMIUM	442	10	22.58		7.01	1	31.65
					COBALT	161	50	39.4	*	7.64	1	39.4
					COPPER	301	25	39.12		10.67	1	105
					IRON	418000	100	14654.5		3017.34	6.5	27100
					LEAD	113	3	11.75		3.26	0.5	25
					MAGNESIUM	79800	5000	28854.1		10315.64	2230.25	47900
					ALUMINUM	357000	200	12642.3		2742.8	22.6	19950
		GW (Filtered)			MANGANESE	515	15	184.57		27.47	0.5	440
58793	GW01168W	GW	REAL	12-Aug-93	ALUMINUM	64200	200	12642.3		2742.8	22.6	19950
					BARIUM	545	200	208.14		102.44	25.9	317
					BERYLLIUM	5	5	4.8	*	1.07	0.4	4.8
					CHROMIUM	68.6	10	22.58		7.01	1	31.65
					COPPER	39.3	25	39.12		10.67	1	105
					IRON	65900	100	14654.5		3017.34	6.5	27100
					LEAD	23.9	3	11.75		3.26	0.5	25
					MANGANESE	910	15	331.64		79.59	0.5	584
					NICKEL	42.4	40	32.68		10.58	1	71.6
					POTASSIUM	9110	5000	4472.65		1731.21	243	8370
					VANADIUM	114	50	46.64		13.81	1	123
					SILICON	112000	100	48399.7		15564.97	4399	51650
		GW (Filtered)			MANGANESE	480	15	184.57		27.47	0.5	440

* The BUTL concentration provided represents the maximum background concentration. No BUTL has been determined in these cases.

Table 2.6.1.2-1
Historical RFEDS Data Available for Ponds C-1 and C-2

		Pond C-1	Pond C-2
FIELD CONSTITUENTS			
	pH	x	x
	Specific Conductance	x	x
	Dissolved Oxygen	x	x
	Water Temperature	x	x
	Alkalinity	x	x
RADIONUCLIDES			
	AMERICIUM-241	x	x
	CESIUM-137	x	x
	CURIUM-244	x	x
	GROSS ALPHA	x	x
	GROSS BETA	x	x
	NEPTUNIUM-237	x	
	PLUTONIUM-239/240	x	x
	RADIUM-226	x	x
	STRONTIUM-89/90	x	x
	THORIUM-230	x	x
	THORIUM-232	x	x
	TRITIUM	x	x
	URANIUM-233,-234	x	x
	URANIUM-235	x	x
	URANIUM-238	x	x
MAJOR CATIONS and TRACE METALS			
	ALUMINUM	x	x
	ANTIMONY	x	x
	ARSENIC	x	x
	BARIUM	x	x
	BERYLLIUM	x	x
	CADMIUM	x	x
	CALCIUM	x	x
	CESIUM	x	x
	CHROMIUM	x	x
	COBALT	x	x
	COPPER	x	x
	IRON	x	x
	LEAD	x	x
	LITHIUM	x	x
	MAGNESIUM	x	x
	MANGANESE	x	x
	MERCURY	x	x
	MOLYBDENUM	x	x
	NICKEL	x	x
	POTASSIUM	x	x
	SELENIUM	x	x
	SILICON	x	x
	SILVER	x	x
	SODIUM	x	x
	STRONTIUM	x	x
	THALLIUM	x	x
	TIN	x	x
	VANADIUM	x	x
	ZINC	x	x
WATER-QUALITY CONSTITUENTS			
	ALKALINITY AS CACO3	x	x
	AMMONIA	x	x
	BICARBONATE	x	x
	BICARBONATE AS CACO3	x	x
	CARBONATE AS CACO3	x	x
	CHLORIDE	x	x
	CYANIDE	x	x
	DISSOLVED ORGANIC CARBON	x	x
	FLUORIDE	x	x
	HEXAVALENT CHROMIUM	x	x
	NITRATE		x
	NITRATE/NITRITE	x	x
	NITRITE	x	x
	OIL and GREASE	x	x
	ORTHOPHOSPHATE	x	x
	PHOSPHATE		x
	PHOSPHORUS	x	x
	SILICA, DISSOLVED		x
	SULFATE	x	x
	SULFIDE	x	x
	TOTAL DISSOLVED SOLIDS	x	x
	TOTAL ORGANIC CARBON	x	x
	TOTAL SUSPENDED SOLIDS	x	x

Table 2.6.1.2-1
Historical RFEDS Data Available for Ponds C-1 and C-2

		Pond C-1	Pond C-2
VOLATILE ORGANIC COMPOUNDS 1)			
	1,1,1,2-TETRACHLOROETHANE	X	X
	1,2-DIBROMOETHANE	X	X
	1,2-DIMETHYLBENZENE	X	X
	1,2,3-TRICHLOROBENZENE	X	X
	1,2,3-TRICHLOROPROPANE	X	X
	1,3-DICHLOROPROPANE	X	X
	1,3-DIMETHYLBENZENE	X	X
	2-CHLOROETHYL VINYL ETHER		X
	2-PROPENENITRILE		X
	BENZENE, 1,2,4-TRIMETHYL	X	X
	BENZENE, 1,3,5-TRIMETHYL-	X	X
	BROMOBENZENE	X	X
	BROMOCHLOROMETHANE	X	X
	cis-1,2-DICHLOROETHENE	X	X
	CUMENE	X	X
	DIBROMOMETHANE	X	X
	DICHLORODIFLUOROMETHANE	X	X
	n-BUTYLBENZENE	X	X
	n-PROPYLBENZENE	X	X
	o-CHLOROTOLUENE	X	X
	p-CHLOROTOLUENE	X	X
	p-CYMENE	X	X
	PROPANE, 1,2-DIBROMO-3-CHLORO-	X	X
	sec-BUTYLBENZENE	X	X
	sec-DICHLOROPROPANE	X	X
	tert-BUTYLBENZENE	X	X
	trans-1,2-DICHLOROETHENE	X	X
	TRICHLOROFLUOROMETHANE	X	X
SEMI-VOLATILE ORGANIC COMPOUNDS 2)			
	BENZIDINE		X
	N-NITROSODIETHYLAMINE		X
	N-NITROSODIMETHYLAMINE		X
	N-NITROSODI-N-BUTYLAMINE		X
	N-NITROSOPYRROLIDINE		X
	p-XYLENE		X
PESTICIDES and PCBs 3)			
	2,3,7,8-TCDD	X	X
HERBICIDES			
	2,2-DICHLOROPROPANOIC ACID	X	X
	2,4-DB	X	X
	2,4-DICHLOROPHENOXYACETIC ACID	X	X
	2,4,5-TRICHLOROPHENOXYACETIC ACID	X	X
	AMETRYN	X	X
	ATRATON	X	X
	ATRAZINE	X	X
	CYANZINE	X	X
	DICAMBA	X	X
	DICHLOROPROP	X	X
	MCPA	X	X
	MCPP	X	X
	PHENOL, 2-(1-METHYLPROPYL)-4,6	X	X
	PROMETON	X	X
	PROMETRYN	X	X
	PROPANOIC ACID, 2-(2,4,5-TRICH	X	X
	PROPAZINE	X	X
	SIMAZINE	X	X
	SIMETRYN	X	X
	TERBUTHYLAZINE	X	X
	TERBUTRYN	X	X

1) All 35 analytes on Table 3-4 (EG&G, 1993i), plus those analytes listed on this table.
2) All 65 analyte on Table 3-4 (EG&G, 1993i), plus those analytes listed on this table.
3) All analytes on Table 3-4 (EG&G, 1993i), except chlordane and endrin aldehyde not available for Pond C1. Additional analytes are listed on this table.

Table 2.6.1.2-2: Summary of Constituents Exceeding Background Historical Pond C-1 Water-Quality Constituents

Metals

Analyte Name	BUTL[1]	Max Conc.[2]	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Aluminum, Dissolved	475		7	3	43.8	653	356	UG/L
Cadmium, Dissolved		3.5	7	1	0	4.60	1.13	UG/L
Calcium, Dissolved	50,300		8	2	41,000	56,500	47,663	UG/L
Iron, Dissolved	561		8	3	6.30	1,110	487	UG/L
Magnesium, Dissolved	9,800		8	3	8,510	10,800	9,346	UG/L
Magnesium, Total	9,800		4	2	8,300	10,100	9,235	UG/L
Manganese, Dissolved	139		8	3	28.7	300	126	UG/L

Radionuclides Analyses

Analyte Name	BUTL[1]	Max Conc.[2]	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Americium-241, Total	0.02		4	1	0.001	0.023	0.008	PCI/L
Plutonium-238, Dissolved	0.07		187	2	-0.017	0.162	0.004	PCI/L

Water Quality Parameters

Analyte Name	BUTL[1]	Max Conc.[2]	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Bicarbonate as $CaCo_3$	191,320		8	1	46,100	194,000	145,263	UG/L
Carbonate as $CaCo_3$	7,510		9	1	5,000	13,500	5,944	UG/L

Semi-Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
Bis(2-Ethylhexyl)Phthalate	10	9	2	1	5	4.11	UG/L
Diethyl Phthalate	10	9	1	2	5	4.67	UG/L

Volatile Organics

Analyte Name	Detection Limit[3]	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
Acetone	10	9	3	5	45	15.7	UG/L
Methylene Chloride	0 & 5	15	3	1	18	4.27	UG/L

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1) BUTL values from EG&G (1993i).
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comprisons.
3) Variable detecton limits are reported for individual analytes.

Table 2.6.1.2-3: Summary of Constituents Exceeding Background Historical Pond C-2 Water-Quality Constituents

Metals

Analyte Name	BUTL[1)]	Max Conc.[2)]	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Aluminum, Dissolved	475		119	13	10	5030	265.81	UG/L
Aluminum, Total	3893		13	1	14.0	4180	499	UG/L
Antimony, Dissolved	59.2		117	1	0	60	8.97	UG/L
Arsenic, Total	5.84		15	1	1.0	10.0	2.8	UG/L
Barium, Dissolved	127.7		119	1	36.7	200	83.17	UG/L
Barium, Total\	138.1		15	1	49.0	202	85.8	UG/L
Calcium, Dissolved	50300		119	24	15600	108000	42,792.44	UG/L
Calcium, Total	49500		15	2	26.5	109.0	44.8	UG/L
Copper, Dissolved	17.5		118	1	0	25	3.45	UG/L
Copper, Total	17.0		15	1	2.0	25.0	6.9	UG/L
Iron, Dissolved	561		119	22	3	3390	298.84	UG/L
Lead, Dissolved	5.14		118	1	0	6.2	0.74	UG/L
Lead, Total	7.36		15	2	0.6	73.0	7.2	UG/L
Lithium, Dissolved	63.7		36	3	7.4	500	41.7	UG/L
Lithium, Total	52.4		12	2	8.3	500	59.6	UG/L
Magnesium, Dissolved	9800		119	117	3960	19000	14,337.23	UG/L
Magnesium, Total	9800		15	14	7.70	17.0	14.5	UG/L
Manganese, Dissolved	139		117	52	0	228	16.52	UG/L
Manganese, Total	885		15	1	3.3	1000	157	UG/L
Potassium, Dissolved	3600		119	119	3040	7900	5,717.23	UG/L
Potassium, Total	4200		15	15	4.90	12.0	6.39	UG/L
Selenium, Dissolved	13.26		117	1	0	44.8	1.54	UG/L
Selenium, Total	6.33		15	1	1.0	10.2	3.0	UG/L
Sodium, Dissolved	34100		119	115	17400	63200	48,562.18	UG/L
Sodium, Total	33800		15	14	27.6	61.0	49.4	UG/L
Strontium, Dissolved	972.4		107	1	125	1000	351.57	UG/L
Strontium, Total	590.1		13	1	220	1000	390	UG/L
Tin, Dissolved	83.05		106	4	0	2000	44.80	UG/L
Tin, Total	67.07		12	2	11.0	2000	190	UG/L
Vanadium, Total	28.8		14	1	2.0	50.0	8.1	UG/L
Zinc, Dissolved	55.9		117	3	0	228	16.52	UG/L
Zinc, Total	175.6		15	1	3.0	396	42.5	UG/L

Radionuclides Analyses

Analyte Name	BUTL[1)]	Max Conc.[2)]	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Americium-241, Dissolved	0.50		99	1	-0.029	0.505	0.016	PCI/L
Americium-241, Total	0.02		15	2	-0.003	1.028	0.077	PCI/L
Plutonium-239/240, Dissolved	0.79		93	1	-0.012	0.851	0.028	PCI/L
Plutonium-239/240, Total	0.02		26	6	-0.000	0.073	0.018	PCI/L
Uranium-233/234, Total	2.16		19	4	0.250	2.625	1.293	PCI/L
Uranium-238, Total	1.73		19	6	0.318	4.060	1.706	PCI/L

Water Quality Parameters

Analyte Name	BUTL[1)]	Max Conc.[2)]	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
pH	9.32		370	2	6.6	10.3	8.3	Std. Units
Bicarbonate	191		36	13	102	210	173	MG/L
Chloride	53.2		55	14	33.0	61.0	49.2	MG/L
Fluoride	0.59		54	52	0.50	0.80	0.67	MG/L
Nitrite/Nitrate	1.35		64	3	0.01	3.10	0.27	MG/L
Oil and Grease	12.8		16	3	5.00	21.0	8.37	MG/L
Phosphorus	0.17		25	7	0.01	0.54	0.151	MG/L
Sulfate	37.8		54	27	10.0	80.0	41.3	MG/L
Total Dissolved Solids	302		123	90	1	522	353	MG/L
Total Suspended Solids	126		255	1	0	211	15.9	MG/L

Table 2.6.1.2-3 (cont.): Summary of Constituents Exceeding Background Historical Pond C-2 Water-Quality Constituents

Pesticides/PCBs

Analyte Name	Detection Limit [3]	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
Ametryn	0.06 & 0.6	59	1	0.18	180	6.30	UG/L
Atrazine	0.05 & 0.5	70	46	0.14	700	19.4	UG/L
Cyanazine	1	56	1	0.30	300	11.0	UG/L
Prometon	0.03 & 0.3	59	1	0.09	90.0	3.15	UG/L
Prometryn	0.06 & 0.6	60	1	0.18	180	6.19	UG/L
Propazine	0.03 & 0.3	59	1	0.09	90.0	3.15	UG/L
Simazine	0.06 & 0.6	59	2	0.10	180	6.30	UG/L
Simetryn	0.07 & 0.7	59	1	0.21	210	7.35	UG/L
Terbuthylazine	0.03 & 0.3	59	1	0.09	90.0	3.15	UG/L

Semi-Volatile Organics

Analyte Name	Detection Limit [3]	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
Bis(2-Ethylhexyl)Phthalate	10 - 16	18	9	2.00	44.0	11.5	UG/L
DI-n-Butyl Phthalate	10 - 16	18	2	2.30	10.0	9.18	UG/L

Volatile Organics

Analyte Name	Detection Limit [3]	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
1,1-Dichloroethane	4 & 5	115	1	0.20	5.00	4.17	UG/L
1,1,1-Trichloroethane	4 & 5	116	3	0.10	7.00	4.20	UG/L
1,1,2-Trichloroethane	4 & 5	115	1	0.14	5.00	4.17	UG/L
1,1,2,2-Tetrachloroethane	5	115	1	0.10	5.00	4.17	UG/L
1,2-Dichloroethane	4 & 5	115	1	0.10	5.00	4.17	UG/L
1,2-Dichloropropane	5	115	1	0.10	5.00	4.17	UG/L
1,2-Dimethylbenzene	Not Available	50	2	0.20	5.00	3.12	UG/L
2-Butanone	10	96	8	1.00	100	27.3	UG/L
2-Hexanone	10	96	2	1.00	50.0	19.4	UG/L
Acetone	10	95	27	1.00	100	23.2	UG/L
Benzene	5	115	1	0.20	5.00	4.22	UG/L
Bromodichloromethane	5	115	2	0.20	5.00	4.17	UG/L
Carbon Disulfide	5	96	1	2.00	5.00	4.97	UG/L
Carbon Tetrachloride	4 & 5	115	2	0.20	10.0	4.22	UG/L
Chlorobenzene	5	115	2	0.10	5.00	4.25	UG/L
Chloroethane	10	114	1	0.20	10.0	8.29	UG/L
Chloroform	4 & 5	115	3	0.10	5.00	4.14	UG/L
Chloromethane	10	114	1	0.20	10.0	8.34	UG/L
cis-1,3-Dichloropropene	5	115	1	0.10	5.00	4.17	UG/L
Ethylbenzene	5	115	1	0.20	5.00	4.22	UG/L
Methylene Chloride	5	115	19	1.00	12.0	3.97	UG/L
Tetrachloroethene	4 & 5	115	3	0.04	13.0	4.23	UG/L
Toluene	5	115	4	0.20	6.00	4.16	UG/L
Total Xylenes	5	96	5	1.00	6.00	4.91	UG/L
Trichloroethene	4 & 5	114	3	0.04	15.0	4.23	UG/L

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1) BUTL values from EG&G (1993i).
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comprisons.
3) Variable or no detection limits are reported for individual analytes.

Table 2.6.2.1-1
FSP - C1 and C2 Pond-Sediment TAL-Metals, Radionuclides[1], Organics and Quality Variables Above BUTL

Location[2]	Sample ID	QC	Group[3]	Result Type[4]	Chemical	Result	Qual[5]	Det Lmt	Valid[6]	Background Data Summary[7] BUTL	Mean	Min	Max
Total TAL-Metal Concentrations (mg/kg)													
SED508	SD50014WC	REAL	SMETCLP	TRG	MERCURY	1.155	N*	0.1	JA	0.46	0.12	0.01	0.5
SED509	SD50016WC	REAL	SMETCLP	TRG	BARIUM	262		40	JA	253.82	74.47	6.5	244
SED509	SD50016WC	REAL	SMETCLP	TRG	MERCURY	1.3	N*	0.1	JA	0.46	0.12	0.01	0.5
SED510	SD50017WC	REAL	SMETCLP	TRG	MERCURY	1.6	N*	0.1	JA	0.46	0.12	0.01	0.5
SED511	SD50023WC	REAL	SMETCLP	TRG	MERCURY	0.65	N*	0.1	JA	0.46	0.12	0.01	0.5
SED512	SD50024WC	REAL	SMETCLP	TRG	CALCIUM	33600		1000	V	18446.12	3554.57	93.5	17100
SED512	SD50024WC	REAL	SMETCLP	TRG	MERCURY	0.65	N*	0.1	JA	0.46	0.12	0.01	0.5
SED512	SD50024WC	REAL	SMETCLP	TRG	ZINC	150		4	V	139.04	44.44	6.1	155
SED513	SD50025WC	REAL	SMETCLP	TRG	CALCIUM	47700		1000	JA	18446.12	3554.57	93.5	17100
SED513	SD50025WC	REAL	SMETCLP	TRG	MERCURY	0.68	N*	0.1	JA	0.46	0.12	0.01	0.5
SED513	SD50025WC	REAL	SMETCLP	TRG	ZINC	201		4	JA	139.04	44.44	6.1	155
VOC Sediment-Quality Concentrations (mg/kg)													
SED508	SD50014WC	REAL	BNACLP	TRG	BENZOIC ACID	410	J	1600	A	8)	8)	8)	8)
SED508	SD50014WC	REAL	VOACLP	TRG	TOLUENE	530		5	V	8)	8)	8)	8)
SED509	SD50016WC	REAL	BNACLP	TRG	BENZOIC ACID	410	J	1600	A	8)	8)	8)	8)
SED509	SD50016WC	REAL	VOACLP	TRG	TOLUENE	520		5	JA	8)	8)	8)	8)
SED510	SD50017WC	REAL	BNACLP	TRG	BENZOIC ACID	190	J	1600	A	8)	8)	8)	8)
SED510	SD50017WC	REAL	BNACLP	TRG	DI-n-BUTYL PHTHALATE	110	J	330	A	8)	8)	8)	8)
SED510	SD50017WC	REAL	VOACLP	TRG	TOLUENE	380		5	V	8)	8)	8)	8)
SED511	SD50023WC	REAL	BNACLP	TRG	BENZOIC ACID	240	J	1600	A	8)	8)	8)	8)
SED511	SD50023WC	REAL	BNACLP	TRG	FLUORANTHENE	140	J	330	A	8)	8)	8)	8)
SED511	SD50023WC	REAL	BNACLP	TRG	PHENOL	150	J	330	A	8)	8)	8)	8)
SED511	SD50023WC	REAL	VOACLP	TRG	TOLUENE	410		5	V	8)	8)	8)	8)
SED512	SD50024WC	REAL	VOACLP	TRG	TOLUENE	340		5	V	8)	8)	8)	8)
SED513	SD50025WC	REAL	VOACLP	TRG	TOLUENE	370		5	JA	8)	8)	8)	8)
Total Sediment-Quality Concentrations (mg/kg)													
SED510	SD50017WC	REAL	WQPL	TRG	TOC	29000		1	V	8)	24000	24000	24000

1) No radionuclides exceeded the BUTLs.
2) As shown on Figure 2.4.3.4-1
3) Analysis method. SMETCLP = Total metals using ICPES method. TRADS = Total radionuclides. WQPL = Water-quality parameter list.
4) TRG = Target.
5) Laboratory qualifier. N* = Spiked sample recovery and duplicate analysis outside control limits (estimated value).
6) Validation code. A = Data acceptable. JA = Estimated, Acceptable. V = Valid data.
7) Background upper tolerance limits (EG&G, 1993d).
8) No BUTL available for VOCs and TOC. For this report, VOC background is considered to be the detection limit.

Table 2.6.2.2-1

Summary of Gain/Loss Measurements in OU5 Based Upon Ground-Water/Surface-Water Elevation Changes Versus Flow Measurements in Woman Creek

RFEDS Well-Point Sections[1)]	Well-Point Gain/Loss Results[2)]	Woman Creek Gain/Loss Sections[1)]	Woman Creek Gain/Loss Results[3)]
	March 1-3, 1993		
51293 - 51393	Gain	1 - 2	* 4)
51393 - 51493	Gain	2 - 3	Gain
51493 - 51593	Loss	3 - 4	Loss
52493 - 52393	*	7 - 6	Loss
52393 - 52293	*	6 - 5	Gain
51593 + 52293 - 52593	*	4+5 - 8	Loss
52593 - 52793	Gain	8 - 9	Gain
52793 - 53393	Gain	9 - 10	Gain
53393 - 53493	Gain	10 - 11	Loss
53493 - 53593	Gain	11 - 12	Gain
53793 - 53693	*	14 - 13	Gain
53593 + 53693 - 53893	*	12+13 - 16	Gain
53893 - 53993	*	16 - 17	Gain
53993 - 54593	Loss	17 - C1	Loss
54593 - 54693	Loss	C1 - 18	Gain
54693 - 54793	Gain	18 - 20	Gain

Table 2.6.2.2-1

Summary of Gain/Loss Measurements in OU5 Based Upon Ground-Water/Surface-Water Elevation Changes Versus Flow Measurements in Woman Creek

RFEDS Well-Point Sections[1)]	Well-Point Gain/Loss Results[2)]	Woman Creek Gain/Loss Sections[1)]	Woman Creek Gain/Loss Results[3)]
	April 6-8 1993		
51293 - 51393	Gain	1 - 2	*
51393 - 51493	Gain	2 - 3	Gain
51493 - 51593	Loss	3 - 4	Gain
52493 - 52393	*	7 - 6	Gain
52393 - 52293	Gain	6 - 5	Gain
51593 + 52293 - 52593	Loss	4+5 - 8	Loss
52593 - 52793	Gain	8 - 9	Gain
52793 - 53393	Gain	9 - 10	Gain
53393 - 53493	Gain	10 - 11	Gain
53493 - 53593	Gain	11 - 12	Gain
53793 - 53693	Gain	14 - 13	Gain
53593 + 53693 - 53893	*	12+13 - 16	Gain
53893 - 53993	*	16 - 17	Loss
53993 - 54593	Gain	17 - C1	Gain
54593 - 54693	Gain	C1 - 18	*
54693 - 54793	Gain	18 - 20	*

Table 2.6.2.2-1

Summary of Gain/Loss Measurements in OU5 Based Upon Ground-Water/Surface-Water Elevation Changes Versus Flow Measurements in Woman Creek

RFEDS Well-Point Sections[1)]	Well-Point Gain/Loss Results[2)]	Woman Creek Gain/Loss Sections[1)]	Woman Creek Gain/Loss Results[3)]
	May 6-7, 1993		
51293 - 51393	Gain	1 - 2	*
51393 - 51493	Gain	2 - 3	Loss
51493 - 51593	Gain	3 - 4	Gain
52493 - 52393	*	7 - 6	Loss
52393 - 52293	Gain	6 - 5	Gain
51593 + 52293 - 52593	*	4+5 - 8	Gain
52593 - 52793	*	8 - 9	Gain
52793 - 53393	Gain	9 - 10	Gain
53393 - 53493	Gain	10 - 11	Loss
53493 - 53593	Gain	11 - 12	Loss
53793 - 53693	Loss	14 - 13	Gain
53593 + 53693 - 53893	*	12+13 - 16	Loss
53893 - 53993	*	16 - 17	Loss
53993 - 54593	Gain	17 - C1	*
54593 - 54693	Gain	C1 - 18	*
54693 - 54793	Gain	18 - 20	Loss

Table 2.6.2.2-1

Summary of Gain/Loss Measurements in OU5 Based Upon Ground-Water/Surface-Water Elevation Changes Versus Flow Measurements in Woman Creek

RFEDS Well-Point Sections[1)]	Well-Point Gain/Loss Results[2)]	Woman Creek Gain/Loss Sections[1)]	Woman Creek Gain/Loss Results[3)]
June 17-18, 1993			
51293 - 51393	Gain	1 - 2	*
51393 - 51493	Gain	2 - 3	*
51493 - 51593	Gain	3 - 4	*
52493 - 52393	*	7 - 6	*
52393 - 52293	*	6 - 5	*
51593 + 52293 - 52593	*	4+5 - 8	*
52593 - 52793	*	8 - 9	*
52793 - 53393	Gain	9 - 10	*
53393 - 53493	Gain	10 - 11	Gain
53493 - 53593	Gain	11 - 12	Gain
53793 - 53693	Loss	14 - 13	*
53593 + 53693 - 53893	*	12+13 - 16	Gain
53893 - 53993	*	16 - 17	Gain
53993 - 54593	Loss	17 - C1	Loss
54593 - 54693	Loss	C1 - 18	Loss
54693 - 54793	Loss	18 - 20	Loss

Table 2.6.2.2-1

Summary of Gain/Loss Measurements in OU5 Based Upon Ground-Water/Surface-Water Elevation Changes Versus Flow Measurements in Woman Creek

RFEDS Well-Point Sections[1)]	Well-Point Gain/Loss Results[2)]	Woman Creek Gain/Loss Sections[1)]	Woman Creek Gain/Loss Results[3)]
July 13-14, 1993			
51293 - 51393	Loss	1 - 2	*
51393 - 51493	Loss	2 - 3	*
51493 - 51593	*	3 - 4	*
52493 - 52393	*	7 - 6	Loss
52393 - 52293	*	6 - 5	*
51593 + 52293 - 52593	*	4+5 - 8	*
52593 - 52793	Loss	8 - 9	Loss
52793 - 53393	*	9 - 10	Gain
53393 - 53493	*	10 - 11	Loss
53493 - 53593	*	11 - 12	*
53793 - 53693	*	14 - 13	*
53593 + 53693 - 53893	*	12+13 - 16	Loss
53893 - 53993	*	16 - 17	Loss
53993 - 54593	Loss	17 - C1	Loss
54593 - 54693	*	C1 - 18	Gain
54693 - 54793	*	18 - 20	Loss

Table 2.6.2.2-1

Summary of Gain/Loss Measurements in OU5 Based Upon Ground-Water/Surface-Water Elevation Changes Versus Flow Measurements in Woman Creek

RFEDS Well-Point Sections[1)]	Well-Point Gain/Loss Results[2)]	Woman Creek Gain/Loss Sections[1)]	Woman Creek Gain/Loss Results[3)]
	August 9-13, 1993		
51293 - 51393	*	1 - 2	*
51393 - 51493	*	2 - 3	*
51493 - 51593	*	3 - 4	*
52493 - 52393	*	7 - 6	*
52393 - 52293	*	6 - 5	*
51593 + 52293 - 52593	*	4+5 - 8	*
52593 - 52793	*	8 - 9	*
52793 - 53393	*	9 - 10	Gain
53393 - 53493	*	10 - 11	Loss
53493 - 53593	*	11 - 12	*
53793 - 53693	*	14 - 13	*
53593 + 53693 - 53893	*	12+13 - 16	Loss
53893 - 53993	Loss	16 - 17	Loss
53993 - 54593	*	17 - C1	*
54593 - 54693	*	C1 - 18	*
54693 - 54793	*	18 - 20	*

Table 2.6.2.2-1

Summary of Gain/Loss Measurements in OU5 Based Upon Ground-Water/Surface-Water Elevation Changes Versus Flow Measurements in Woman Creek

RFEDS Well-Point Sections[1)]	Well-Point Gain/Loss Results[2)]	Woman Creek Gain/Loss Sections[1)]	Woman Creek Gain/Loss Results[3)]
	September 10-14, 1993		
51293 - 51393	*	1 - 2	*
51393 - 51493	*	2 - 3	*
51493 - 51593	*	3 - 4	*
52493 - 52393	*	7 - 6	*
52393 - 52293	*	6 - 5	*
51593 + 52293 - 52593	*	4+5 - 8	*
52593 - 52793	*	8 - 9	*
52793 - 53393	Gain	9 - 10	Gain
53393 - 53493	Loss	10 - 11	Loss
53493 - 53593	*	11 - 12	*
53793 - 53693	*	14 - 13	*
53593 + 53693 - 53893	*	12+13 - 16	*
53893 - 53993	*	16 - 17	Gain
53993 - 54593	*	17 - C1	Loss
54593 - 54693	*	C1 - 18	*
54693 - 54793	*	18 - 20	*

Table 2.6.2.2-1

Summary of Gain/Loss Measurements in OU5 Based Upon Ground-Water/Surface-Water Elevation Changes Versus Flow Measurements in Woman Creek

RFEDS Well-Point Sections[1)]	Well-Point Gain/Loss Results[2)]	Woman Creek Gain/Loss Sections[1)]	Woman Creek Gain/Loss Results[3)]
	October 5, 1993		
51293 - 51393	Gain	1 - 2	Gain
51393 - 51493	*	2 - 3	Loss
51493 - 51593	*	3 - 4	Gain
52493 - 52393	*	7 - 6	*
52393 - 52293	*	6 - 5	*
51593 + 52293 - 52593	*	4+5 - 8	*
52593 - 52793	*	8 - 9	*
52793 - 53393	Gain	9 - 10	Gain
53393 - 53493	Loss	10 - 11	Loss
53493 - 53593	Gain	11 - 12	Gain
53793 - 53693	*	14 - 13	Loss
53593 + 53693 - 53893	*	12+13 - 16	Gain
53893 - 53993	*	16 - 17	Loss
53993 - 54593	Gain	17 - C1	*
54593 - 54693	Gain	C1 - 18	*
54693 - 54793	Loss	18 - 20	*

Table 2.6.2.2-1

Summary of Gain/Loss Measurements in OU5 Based Upon Ground-Water/Surface-Water Elevation Changes Versus Flow Measurements in Woman Creek

RFEDS Well-Point Sections[1)]	Well-Point Gain/Loss Results[2)]	Woman Creek Gain/Loss Sections[1)]	Woman Creek Gain/Loss Results[3)]
	November 9, 1993		
51293 - 51393	Loss	1 - 2	Gain
51393 - 51493	Loss	2 - 3	Loss
51493 - 51593	*	3 - 4	Gain
52493 - 52393	Loss	7 - 6	Loss
52393 - 52293	Loss	6 - 5	Gain
51593 + 52293 - 52593	*	4+5 - 8	Loss
52593 - 52793	Gain	8 - 9	Gain
52793 - 53393	Loss	9 - 10	Gain
53393 - 53493	*	10 - 11	Gain
53493 - 53593	*	11 - 12	Loss
53793 - 53693	*	14 - 13	Loss
53593 + 53693 - 53893	*	12+13 - 16	Gain
53893 - 53993	*	16 - 17	Gain
53993 - 54593	Loss	17 - C1	*
54593 - 54693	Gain	C1 - 18	*
54693 - 54793	Loss	18 - 20	Loss

Table 2.6.2.2-1

Summary of Gain/Loss Measurements in OU5 Based Upon Ground-Water/Surface-Water Elevation Changes Versus Flow Measurements in Woman Creek

RFEDS Well-Point Sections[1)]	Well-Point Gain/Loss Results[2)]	Woman Creek Gain/Loss Sections[1)]	Woman Creek Gain/Loss Results[3)]
December 9, 1993			
51293 - 51393	Loss	1 - 2	Loss
51393 - 51493	Loss	2 - 3	Gain
51493 - 51593	*	3 - 4	Gain
52493 - 52393	*	7 - 6	*
52393 - 52293	Loss	6 - 5	Loss
51593 + 52293 - 52593	*	4+5 - 8	Loss
52593 - 52793	Gain	8 - 9	Gain
52793 - 53393	Loss	9 - 10	Gain
53393 - 53493	*	10 - 11	Loss
53493 - 53593	*	11 - 12	Gain
53793 - 53693	*	14 - 13	Gain
53593 + 53693 - 53893	*	12+13 - 16	Gain
53893 - 53993	*	16 - 17	Loss
53993 - 54593	Loss	17 - C1	*
54593 - 54693	Gain	C1 - 18	*
54693 - 54793	Loss	18 - 20	Loss

Table 2.6.2.2-1

Summary of Gain/Loss Measurements in OU5 Based Upon Ground-Water/Surface-Water Elevation Changes Versus Flow Measurements in Woman Creek

RFEDS Well-Point Sections[1)]	Well-Point Gain/Loss Results[2)]	Woman Creek Gain/Loss Sections[1)]	Woman Creek Gain/Loss Results[3)]
	January 14, 1994		
51293 - 51393	Loss	1 - 2	*
51393 - 51493	*	2 - 3	*
51493 - 51593	*	3 - 4	*
52493 - 52393	*	7 - 6	*
52393 - 52293	*	6 - 5	*
51593 + 52293 - 52593	*	4+5 - 8	*
52593 - 52793	*	8 - 9	*
52793 - 53393	*	9 - 10	*
53393 - 53493	*	10 - 11	*
53493 - 53593	*	11 - 12	*
53793 - 53693	*	14 - 13	*
53593 + 53693 - 53893	*	12+13 - 16	*
53893 - 53993	*	16 - 17	*
53993 - 54593	Loss	17 - C1	*
54593 - 54693	Gain	C1 - 18	*
54693 - 54793	Loss	18 - 20	*

Table 2.6.2.2-1

Summary of Gain/Loss Measurements in OU5 Based Upon Ground-Water/Surface-Water Elevation Changes Versus Flow Measurements in Woman Creek

RFEDS Well-Point Sections[1)]	Well-Point Gain/Loss Results[2)]	Woman Creek Gain/Loss Sections[1)]	Woman Creek Gain/Loss Results[3)]
	February 17, 1994		
51293 - 51393	*	1 - 2	*
51393 - 51493	Loss	2 - 3	Loss
51493 - 51593	Gain	3 - 4	Gain
52493 - 52393	*	7 - 6	*
52393 - 52293	*	6 - 5	*
51593 + 52293 - 52593	*	4+5 - 8	*
52593 - 52793	*	8 - 9	*
52793 - 53393	Loss	9 - 10	Gain
53393 - 53493	Gain	10 - 11	Gain
53493 - 53593	Loss	11 - 12	Loss
53793 - 53693	*	14 - 13	*
53593 + 53693 - 53893	*	12+13 - 16	*
53893 - 53993	*	16 - 17	Gain
53993 - 54593	*	17 - C1	Loss
54593 - 54693	*	C1 - 18	Loss
54693 - 54793	*	18 - 20	Gain

1) Measurement locations are shown on Figure 2.6.2.2-1
2) Average of upstream and downstream groundwater levels minus surface water levels.
3) Downstream minus upstream flow rates.
4) * denotes no data or insufficient data.

Table 2.6.3.1-1: Summary of Constituents Exceeding Background
IHSS 142 Stage 4 Monitoring Well Boreholes

Radionuclides

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Americium-241	0.02		4	1	0.01	0.02	0.02	PCI/G
Plutonium-239/240	0.02		3	2	-0.03	0.16	0.08	PCI/G

Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
ACETONE	10.00	8	2	4.00	5.00	4.88	UG/KG
METHYLENE CHLORIDE	5.00	8	2	2.00	4.00	2.63	UG/KG
TOLUENE	5.00	8	8	3.00	23.00	12.00	UG/KG

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.6.3.1-2: Summary of Constituents Exceeding Background
IHSS 142 Stage 4 Groundwater

Metals

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Aluminum, Total	12,642.33		3	1	5,240.00	35,100.00	17,371.67	UG/L
Barium, Dissolved	163.94		3	2	156.00	257.00	215.83	UG/L
Barium, Total	208.14		3	3	210.00	760.00	431.83	UG/L
Chromium, Total	22.58		3	1	2.50	42.60	19.53	UG/L
Cobalt, Total	39.40	39.40	3	1	2.00	44.70	19.27	UG/L
Copper, Total	39.12		3	1	11.80	50.30	27.02	UG/L
Iron, Dissolved	320.57		3	2	2.50	15,050.00	9,050.83	UG/L
Iron, Total	14,654.53		3	2	4,500.00	71,800.00	35,700.00	UG/L
Lead, Total	11.75		3	1	8.00	39.40	19.22	UG/L
Manganese, Dissolved	184.57		3	2	0.50	2,930.00	1,940.17	UG/L
Manganese, Total	331.64		3	2	94.20	3,530.00	2,018.07	UG/L
Nickel, Total	32.68		3	1	5.50	68.20	30.08	UG/L
Potassium, Total	4,472.65		3	2	4,330.00	7,970.00	5,680.00	UG/L
Silicon, Total	48,399.65		3	1	17,600.00	74,000.00	40,750.00	UG/L
Vanadium, Total	46.64		3	1	1.50	89.60	38.17	UG/L
Zinc, Total	153.21		3	1	37.80	213.00	105.57	UG/L

Radionuclides

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Gross Beta, Dissolved	37.25		5	1	2.98	230.00	49.62	PCI/L
Radium-226, Total	1.29		3	1	0.46	1.55	0.86	PCI/L

Water Quality Parameters

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Chloride	42.37		2	1	35.00	42.70	38.85	MG/L
Total Suspended Solids	1,133.72		2	1	170.00	1,300.00	735.00	MG/L

Semi-Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
BENZO(a)ANTHRACENE	10.00	4	1	4.50	5.00	4.88	UG/L
CHRYSENE	10.00	4	1	4.50	5.00	4.88	UG/L
PYRENE	10.00	4	1	4.00	5.00	4.75	UG/L

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

TABLE 2.6.3.1-3
SUMMARY OF IHSS 142 AQUIFER TEST ANALYSES

AREA/WELL	DATE	DATA TYPE	FILE-NAME(S)	ANALYSIS TYPE	INPUT REQUIRED	DATA INPUT	RESULTS
C-PONDS Aquifer Tests							
PW51193	8/4/93	Hand		Step			
PW51193	8/5/93	Hand+ Transd.	51193.PRN C1TEST	Unconfined Theis	- pumping rate - radius to OW - saturated thick.	0.02 ft3/min 0.08 ft 3.04 ft	T = 0.02185 ft2/min S = 0.1353
							T = 0.01655 ft2/min S = 0.2684*
PW51193	8/5/93	Transd.	51193REC	Recovery	- pumping rate - tot.time pump.	0.02 ft3/min	
PW51193	8/5/93	Hand		Recovery	- pumping rate - tot.time pump.	0.02 ft3/min	
OW63293	8/5/93	Hand	632DD	Unconfined Theis	- pumping rate - radius to OW - saturated thick.	0.02 ft3/min 3.65 ft 1 ft	T = 0.02822 ft2/min S = 0.003369
				Unconfined Jacob			T = 0.03023 ft2/min S = 0.002867 T = 0.0308 ft2/min S = 0.00285
OW63293	8/5/93	Hand		Recovery	- pumping rate - tot.time pump.	0.02 ft3/min	
OW63393	8/5/93	Hand					
OW63493	8/5/93	Hand	634DD 634DDRV	Unconfined Theis	- pumping rate - radius to OW - saturated thick.	0.02 ft3/min 6.4 ft 5.02 ft	T = 0.03022 ft2/min S = 0.0005406
OW63493	8/5/93	Hand		Recovery	- pumping rate - tot.time pump.	0.02 ft3/min	

Table 2.7.3.2-1: Summary of Constituents Exceeding Background IHSS 209 and Other Surface Disturbances Stage 3 Surface Soils

Radionuclides

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Americium-241	0.06		19	4	0.01	0.80	0.07	PCI/G
Plutonium-239/240	0.13		19	8	-0.00	5.01	0.45	PCI/G

Semi-Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
BENZOIC ACID	1,600.00	19	6	180.00	800.00	633.16	UG/KG
BIS(2-ETHYLHEXYL)PHTHALATE	330.00	19	4	54.00	165.00	149.89	UG/KG
ISOPHORONE	330.00	19	1	96.00	165.00	161.37	UG/KG

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.

Table 2.7.3.3-1: Summary of Constituents Exceeding Background
IHSS 209 and Other Surface Disturbances Stage 3 Characterization Boreholes

Metals

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Chromium	76.30		17	1	4.60	108.25	15.78	MG/KG

Radionuclides

Analyte Name	BUTL 1)	Max. Conc. 2)	No. of Analyses	No. of Analyses >BUTL	Site Min.	Site Max.	Site Avg.	Units
Plutonium-239/240	0.02		15	1	-0.01	0.02	0.00	PCI/G

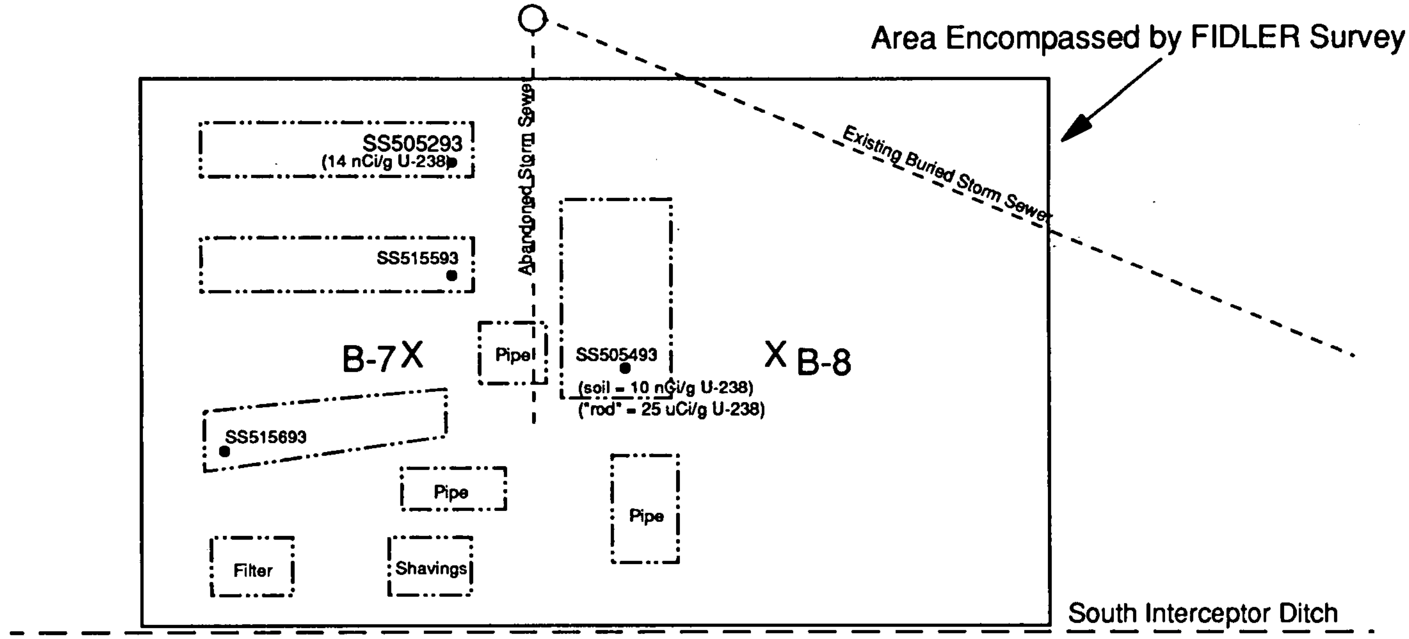
Semi-Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
BENZOIC ACID	1,600.00	13	5	81.00	800.00	525.85	UG/KG

Volatile Organics

Analyte Name	Detection Limit	No. of Analyses	No. of Detects	Site Min.	Site Max.	Site Avg.	Units
METHYLENE CHLORIDE	5.00	26	4	2.50	11.00	3.36	UG/KG

1) Background Upper Tolerance Limit from EG&G (1993i)
2) If this column contains a value, no BUTL has been calculated for this analyte. The maximum background concentration was used for site to background comparisons.



LEGEND

X B-7 HPGe Station

Radiologically Controlled Area (RCA)

• Surficial Soil Sample Location

SS505293 (See Section 2.4.3.1)

(Approximate activity of uranium-238 from portable HPGe detector)

N

NOT TO SCALE

IHSS 115 FIDLER Survey Anomalies
HPGe Stations B-7 and B-8

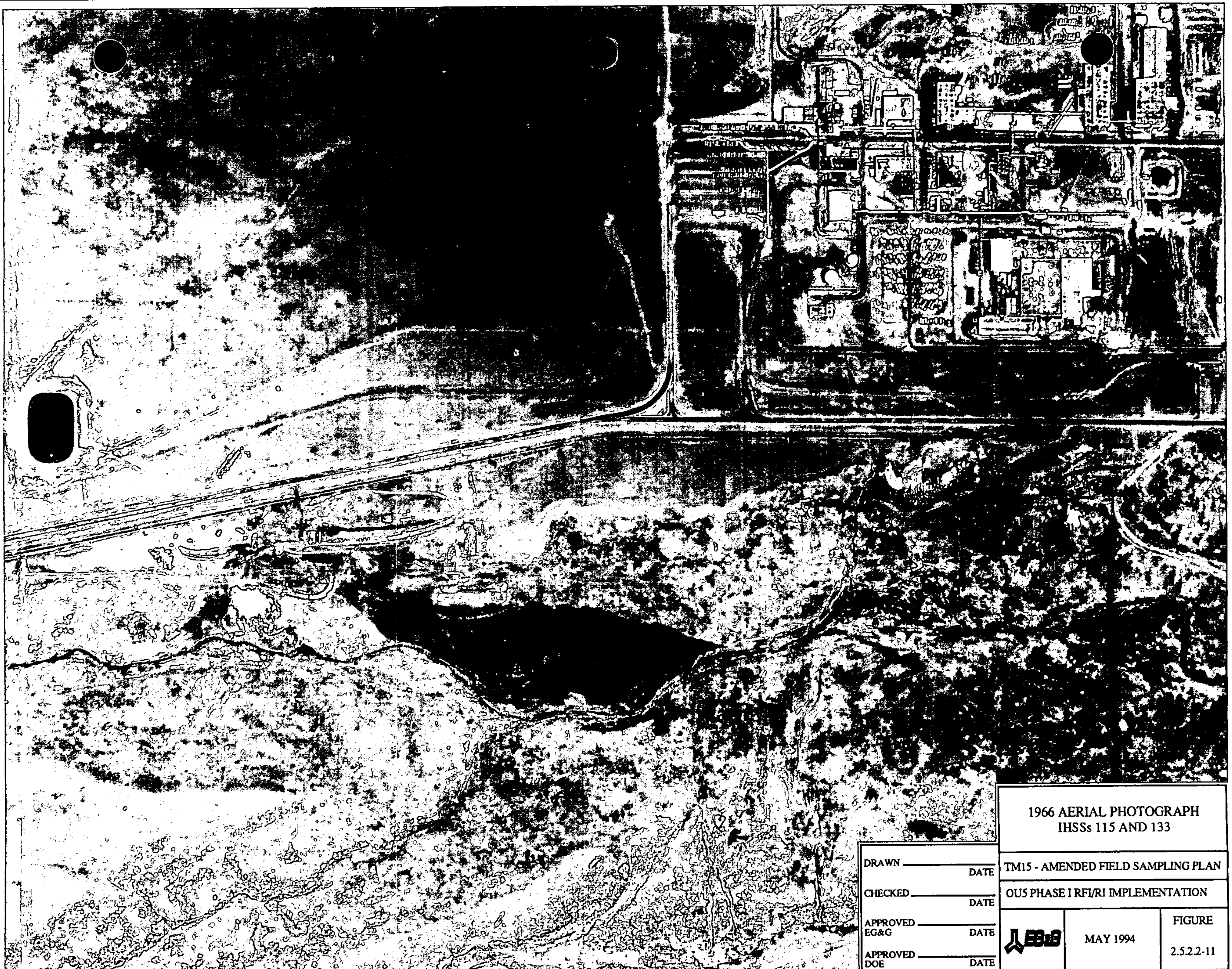
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

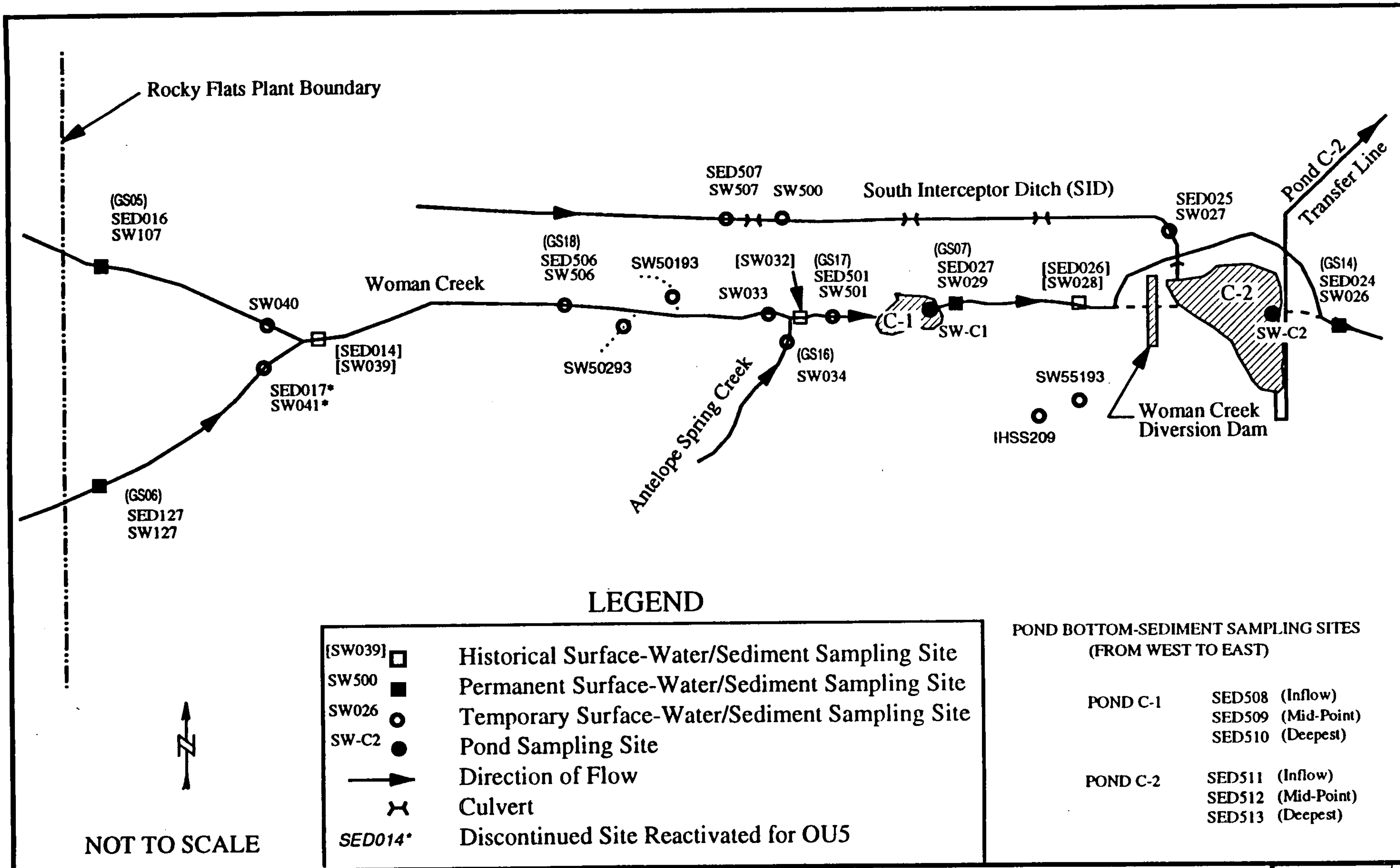
FIGURE 2.4.2.3-1

DRAWN 5/5/94	DATE
CHECKED 5/5/94	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

FILE: F2423-1.DRW



DRAWN ______ DATE	1966 AERIAL PHOTOGRAPH IHSSs 115 AND 133
CHECKED ______ DATE	TM15 - AMENDED FIELD SAMPLING PLAN
APPROVED EG&G ______ DATE	OU5 PHASE I RFI/RI IMPLEMENTATION
APPROVED DOE ______ DATE	EG&G — MAY 1994 — FIGURE 2.5.2.2-11



Historical and OU5-FSP-Related Surface-Water Monitoring Sites
Woman Creek Drainage Basin

EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

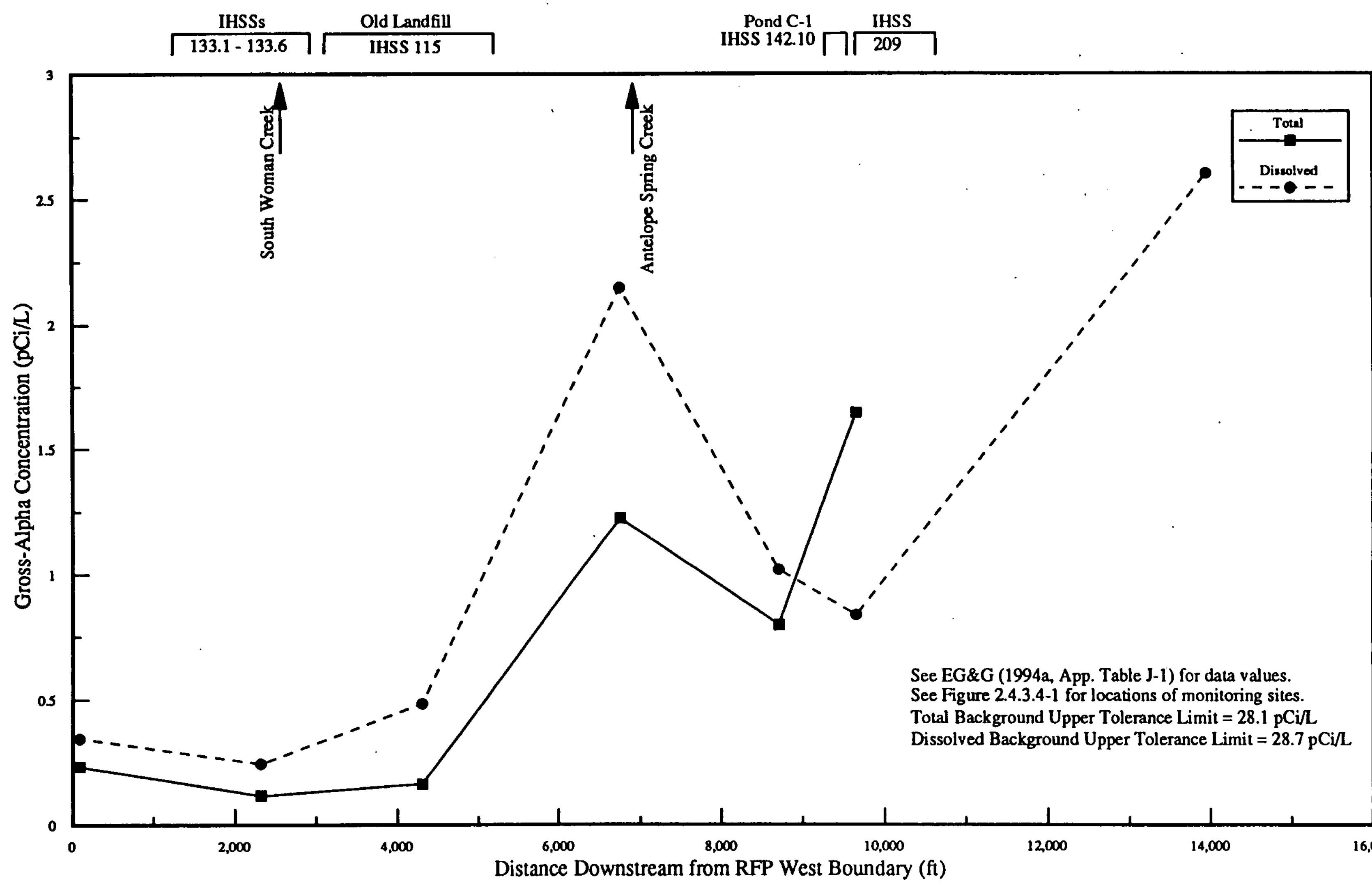
FIGURE 2.4.3.4-1

DRAWN TP 5/11/94 DATE
CHECKED TP 5/11/94 DATE
APPROVED EG&G DATE
APPROVED DOE DATE

FILE: F2434-1.DRW

Status: 04/20/94

Selected IHSS and Tributary Locations Downstream from RFP West Boundary



Surface-Water Gross-Alpha Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 4, 1992

DRAWN TG 5/11/94	DATE
CHECKED TG 5/11/94	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

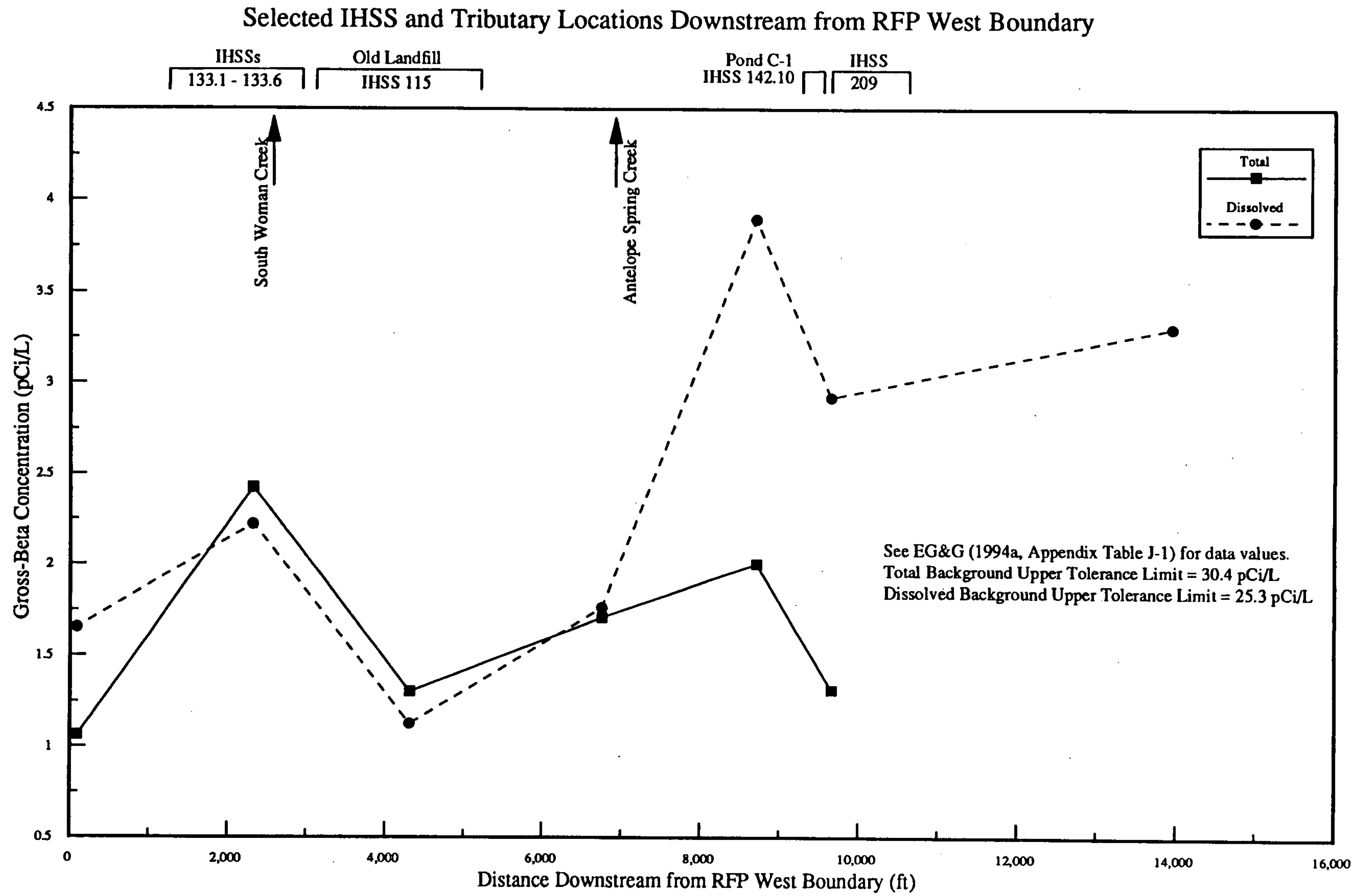
EG&G

ROCKY FLATS PLANT OU 5 RFI/RI
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-2A

FILE: F2434-2A.DRW

Status: 04/25/94



Surface-Water Gross-Beta Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 4, 1992

EG&G

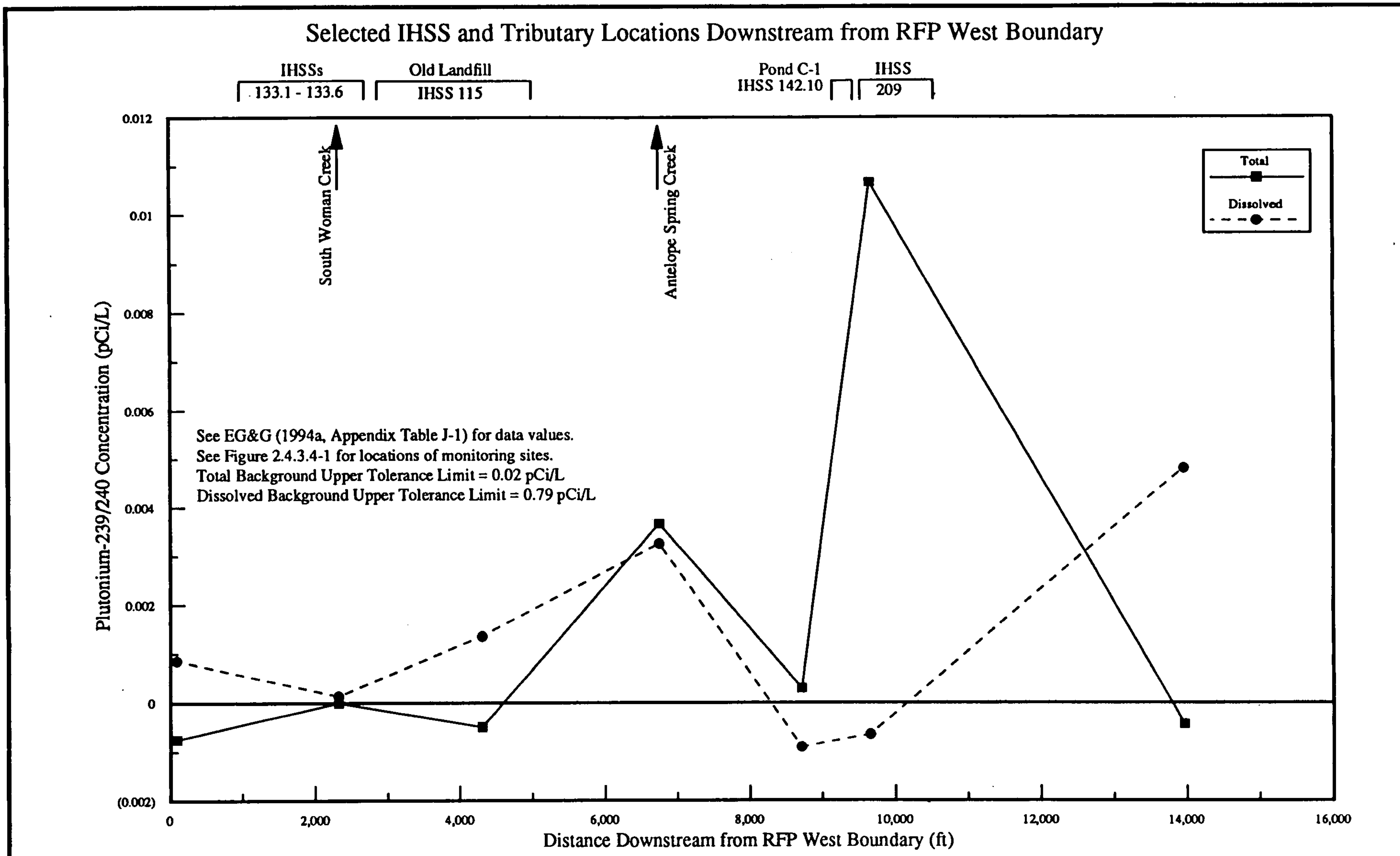
RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-2B

DRAWN TB 5/11/94 DATE
CHECKED [illegible] 5/11/94 DATE
APPROVED EG&G DATE
APPROVED DOE DATE

FILE: F2434-2B.DRW

Status: 04/20/94



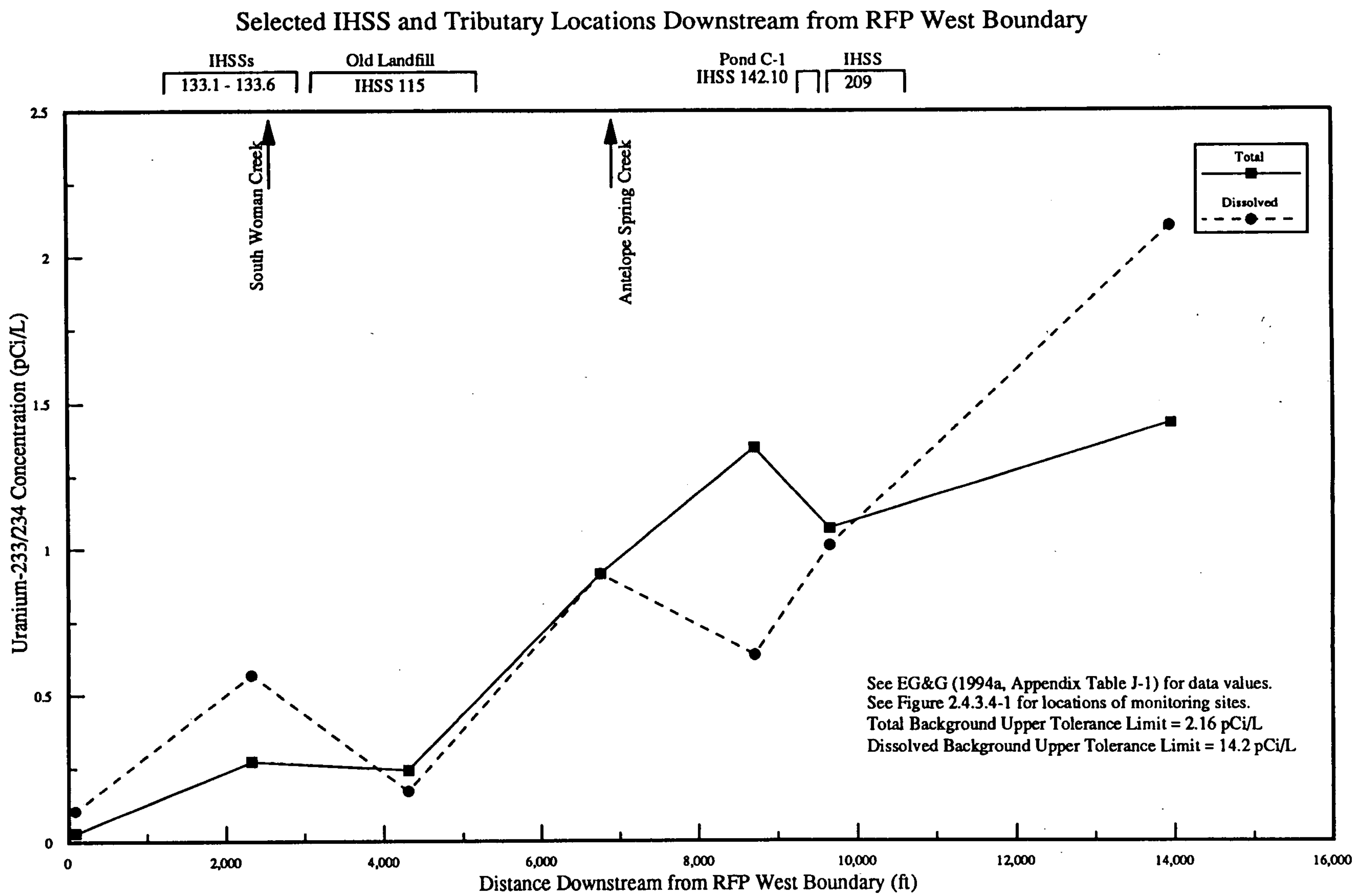
Surface-Water Plutonium-239/240 Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 4, 1992

EG&G	RFP, OU5 RFI/RI, TM15 WOMAN CREEK PRIORITY DRAINAGE	FIGURE 2.4.3.4-2C

DRAWN TR 5/11/94 DATE
CHECKED TJJ 5/11/94 DATE
APPROVED EG&G ____ DATE
APPROVED DOE ____ DATE

FILE: F2434-2C.DRW

Status: 04/20/94



Surface-Water Uranium-233/234 Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 4, 1992

DRAWN 5/11/94 DATE
CHECKED 5/11/94 DATE
APPROVED EG&G DATE
APPROVED DOE DATE

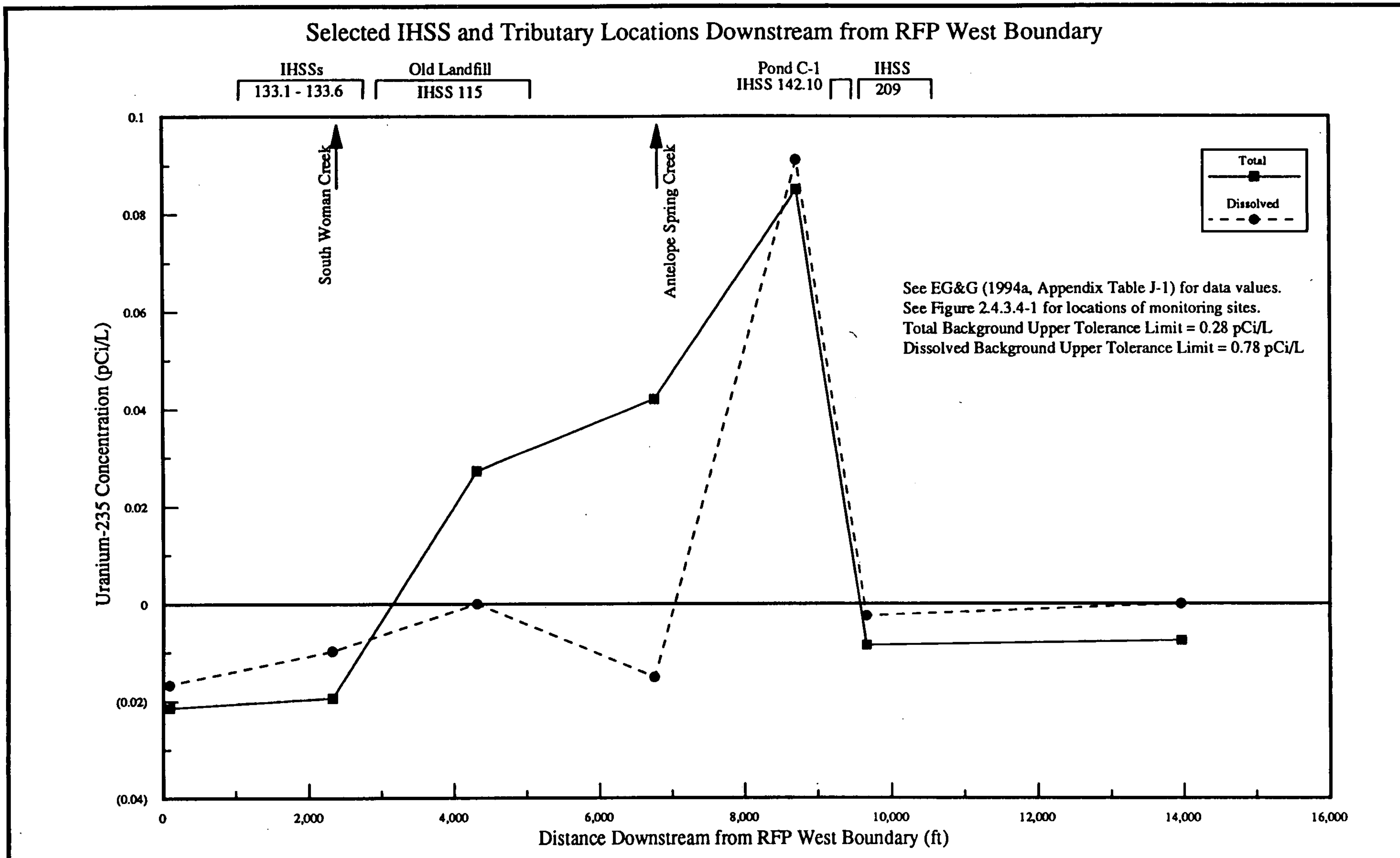
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-2D

FILE: F2434-2D.DRW

Status: 04/20/94



Surface-Water Uranium-235 Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 4, 1992

DRAWN 5/11/94 DATE
CHECKED DATE
APPROVED EG&G DATE
APPROVED DOE DATE

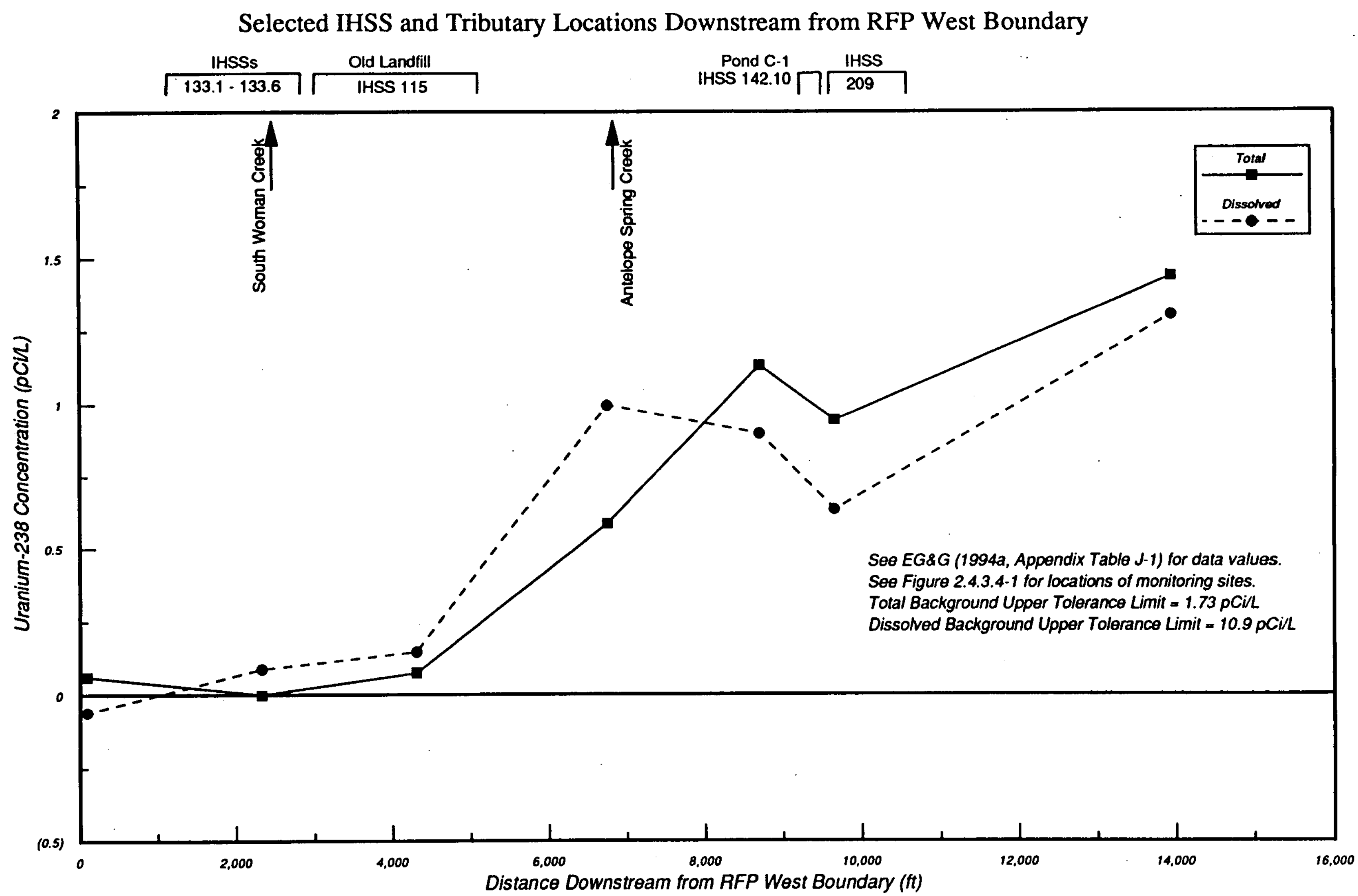
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-2E

FILE: F2434-2E.DRW

Status: 04/20/94



Surface-Water Uranium-238 Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 4, 1992

DRAWN TB 5/11/94	DATE
CHECKED TLP 5/11/94	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

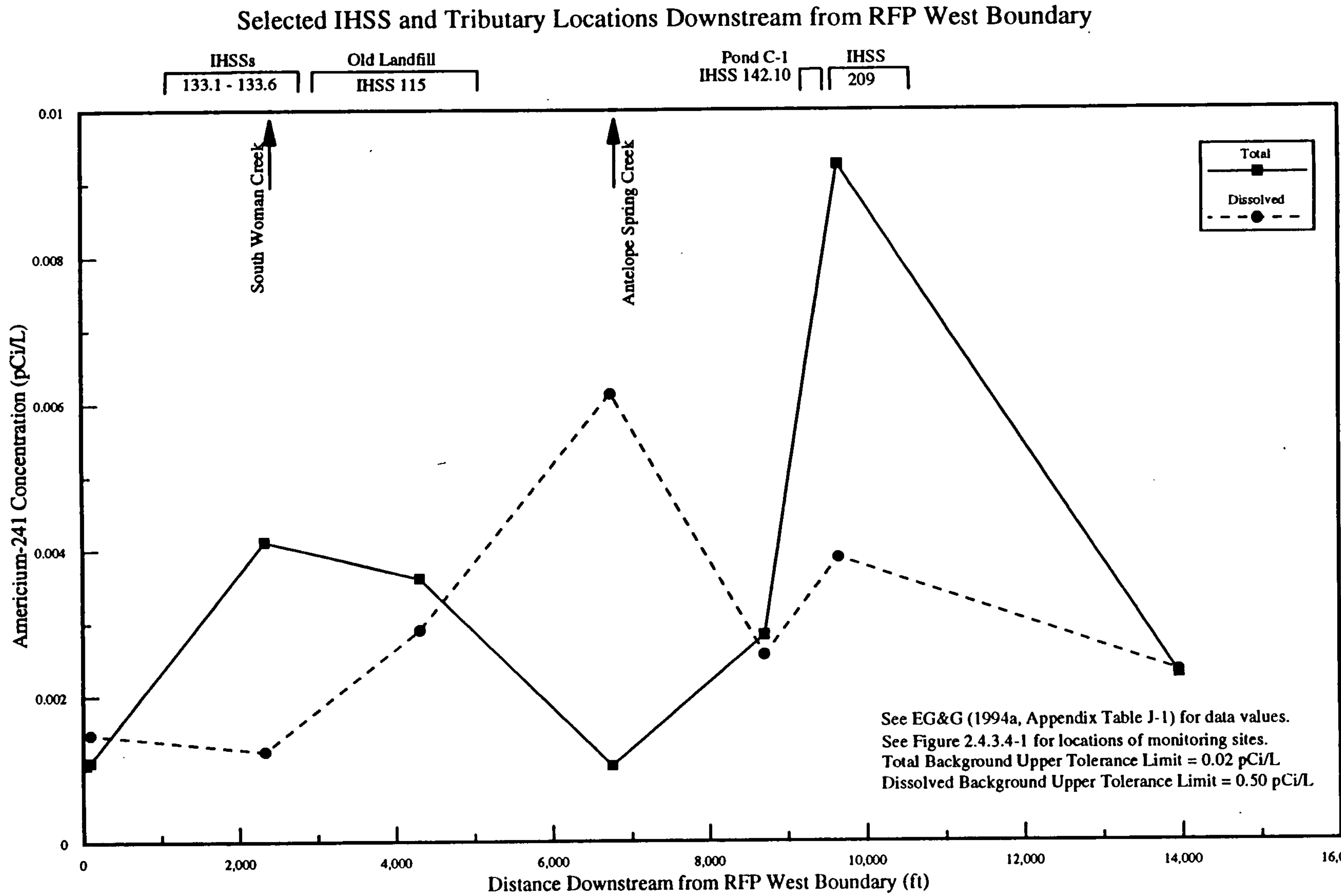
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-2F

FILE: F2434-2F.DRW

Status: 04/20/94



Surface-Water Americium-241 Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 4, 1992

DRAWN TR 5/11/94	DATE
CHECKED [illegible] 5/11/94	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

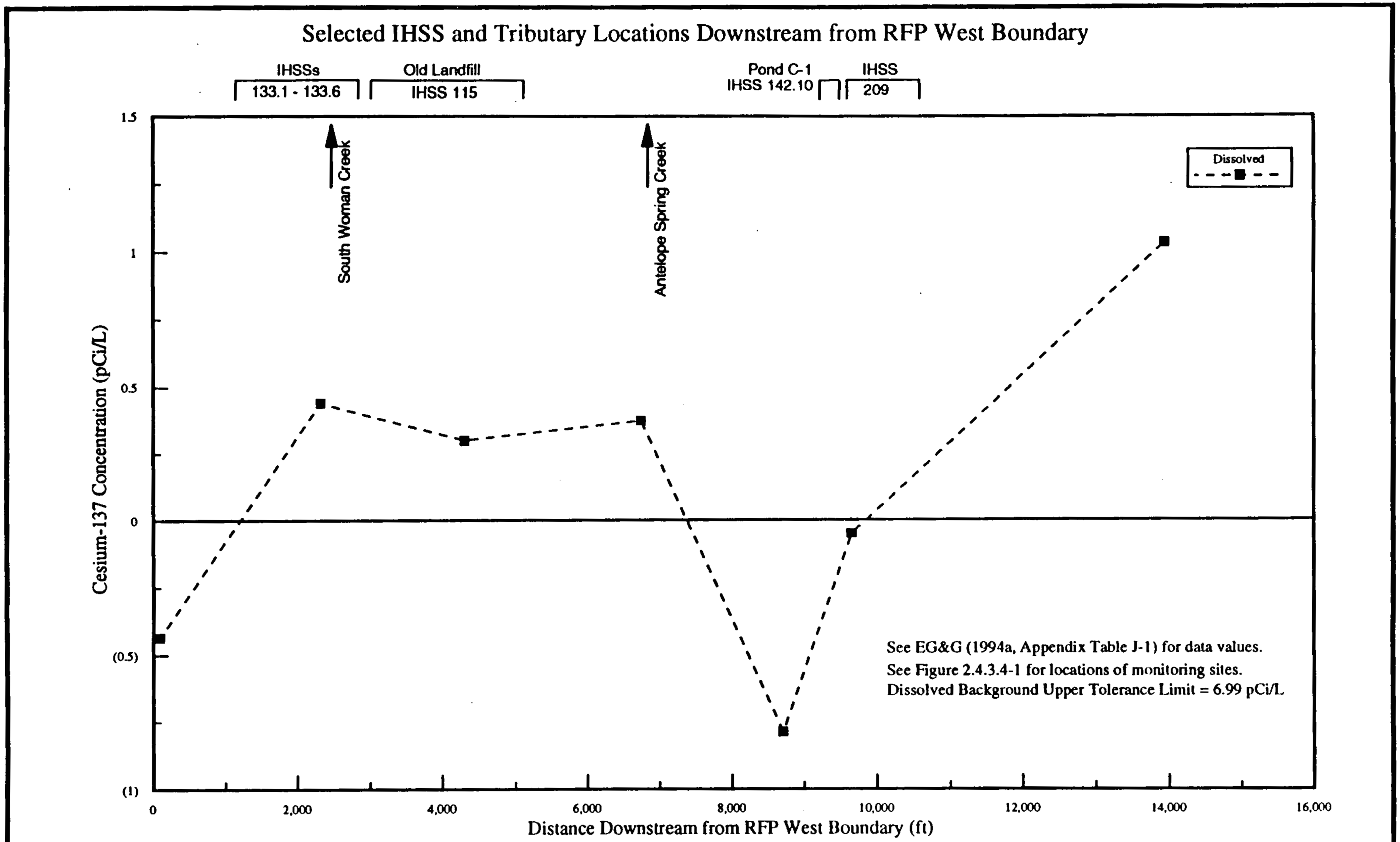
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-2G

FILE: F2434-2G.DRW

Status: 04/12/94



Surface-Water Cesium-137 Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 4, 1992

DRAWN TS	DATE 5/11/94
CHECKED	DATE 5/11/94
APPROVED EG&G	DATE
APPROVED DOE	DATE

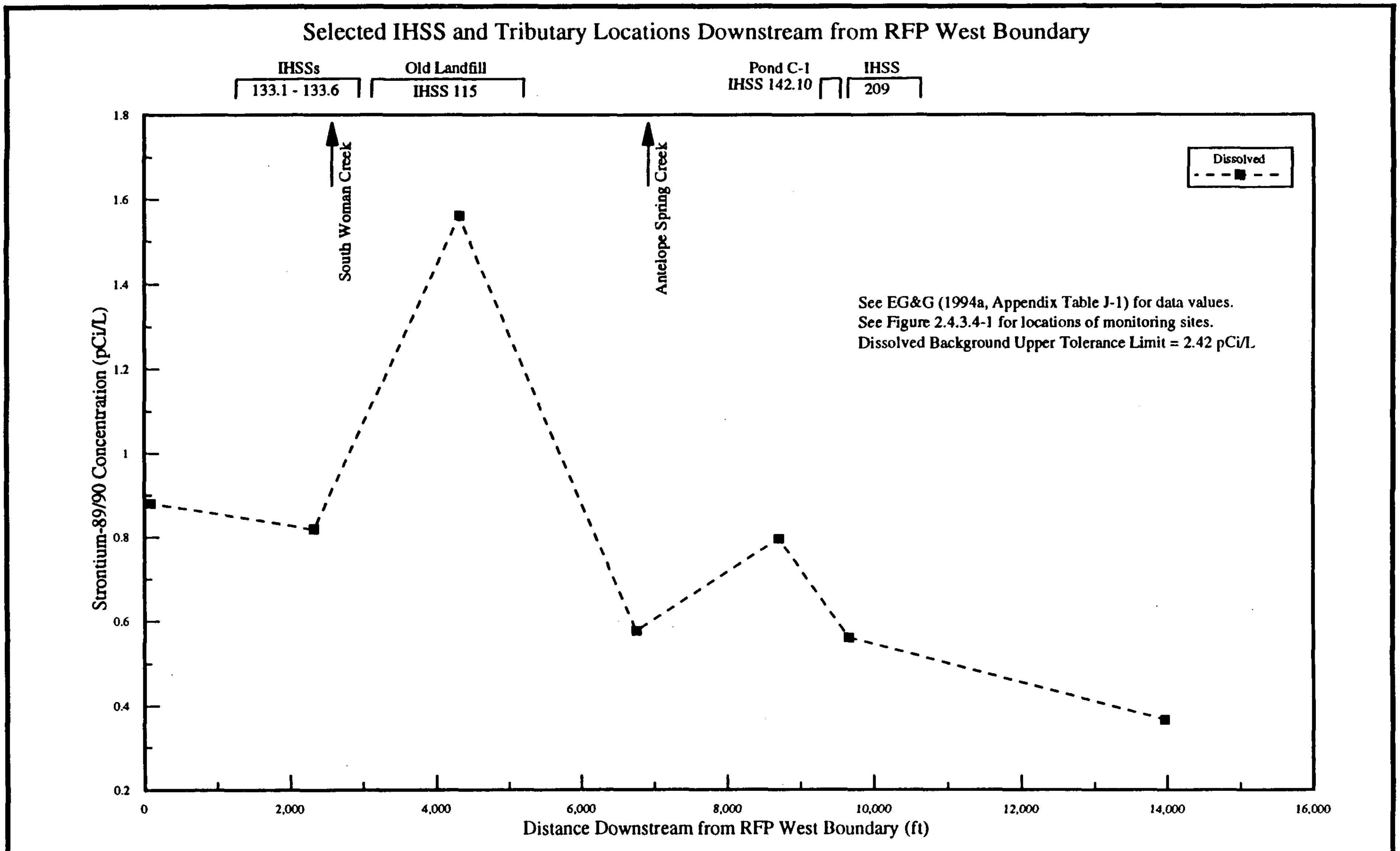
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-2H

FILE: F2434-2H.DRW

Status: 04/20/94



Surface-Water Strontium-89/90 Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 4, 1992

EG&G

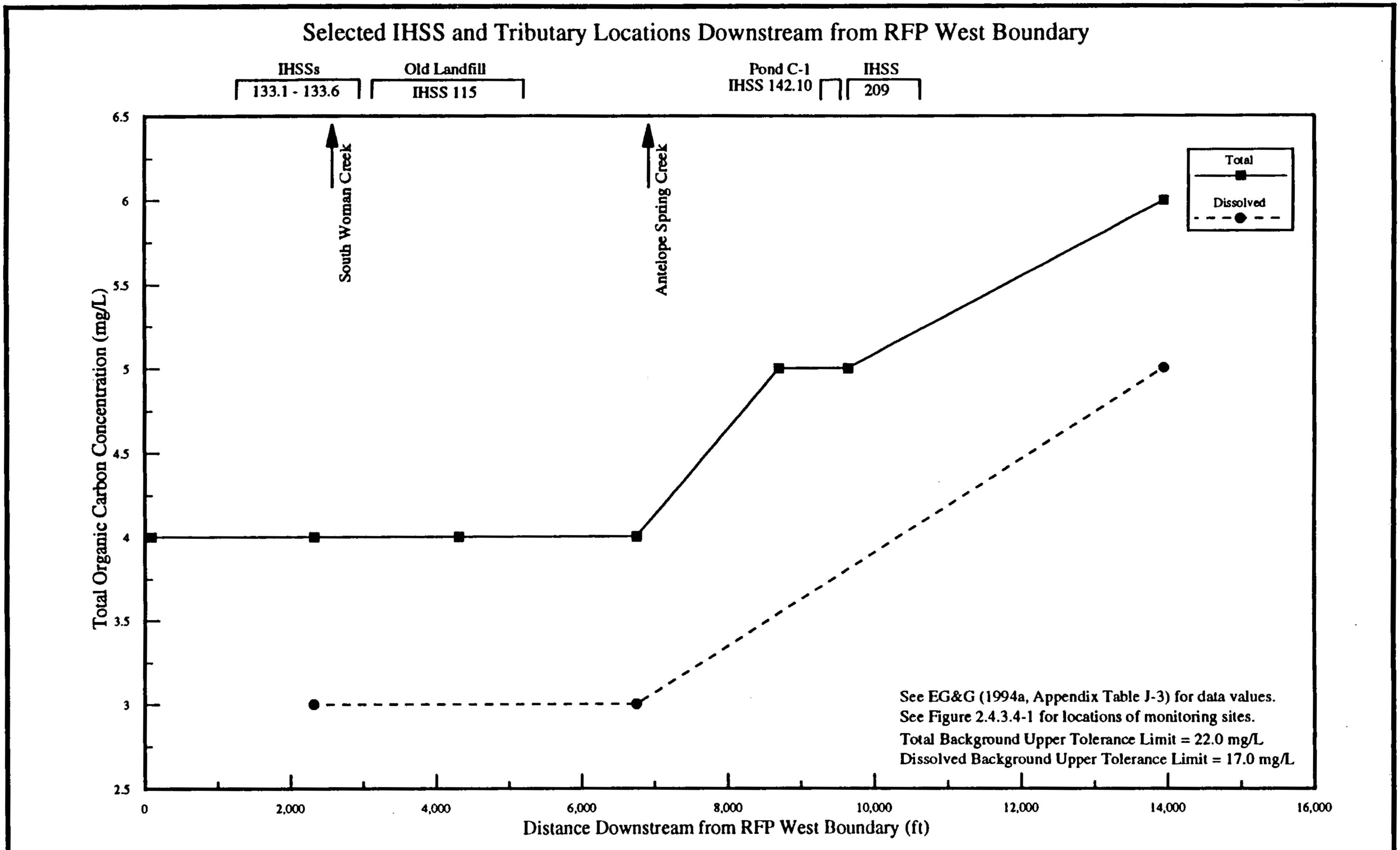
RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-21

DRAWN TS 5/11/94	DATE
CHECKED 5/11/94	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

FILE: F2434-21.DRW

Status: 04/20/94



Surface-Water Total Organic Carbon Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 4, 1992

DRAWN TB 5/11/94 DATE
CHECKED 5/11/94 DATE
APPROVED EG&G DATE
APPROVED DOE DATE

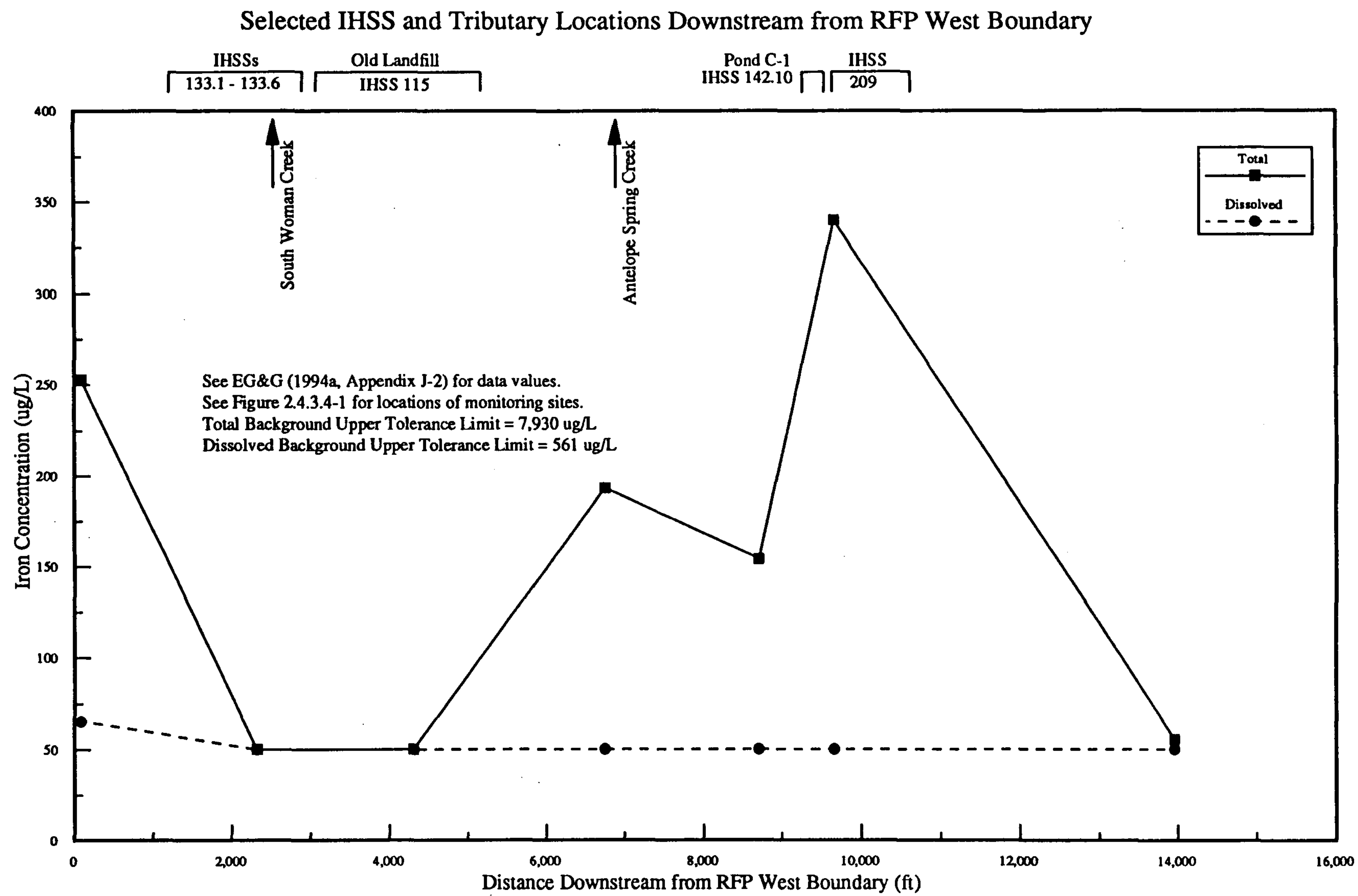
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-2J

FILE: F2434-2J.DRW

Status: 04/20/94



Surface-Water Iron Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 4, 1992

EG&G

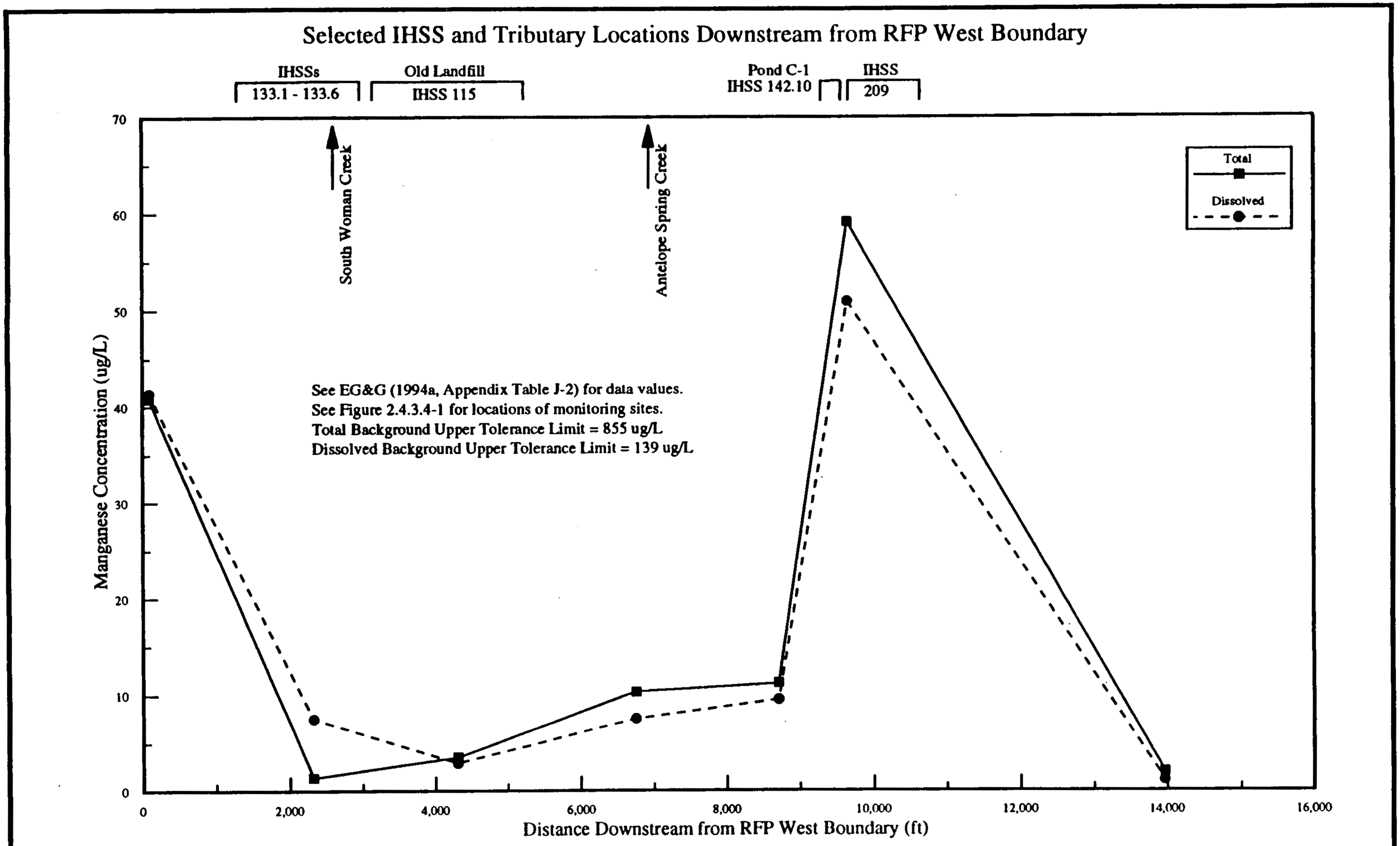
RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-2K

DRAWN TB 5/11/94	DATE
CHECKED TJ 5/11/94	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

FILE: F2434-2K.DRW

Status: 04/20/94



Surface-Water Manganese Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 4, 1992

DRAWN TS 5/11/94	DATE
CHECKED [illegible] 5/11/94	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

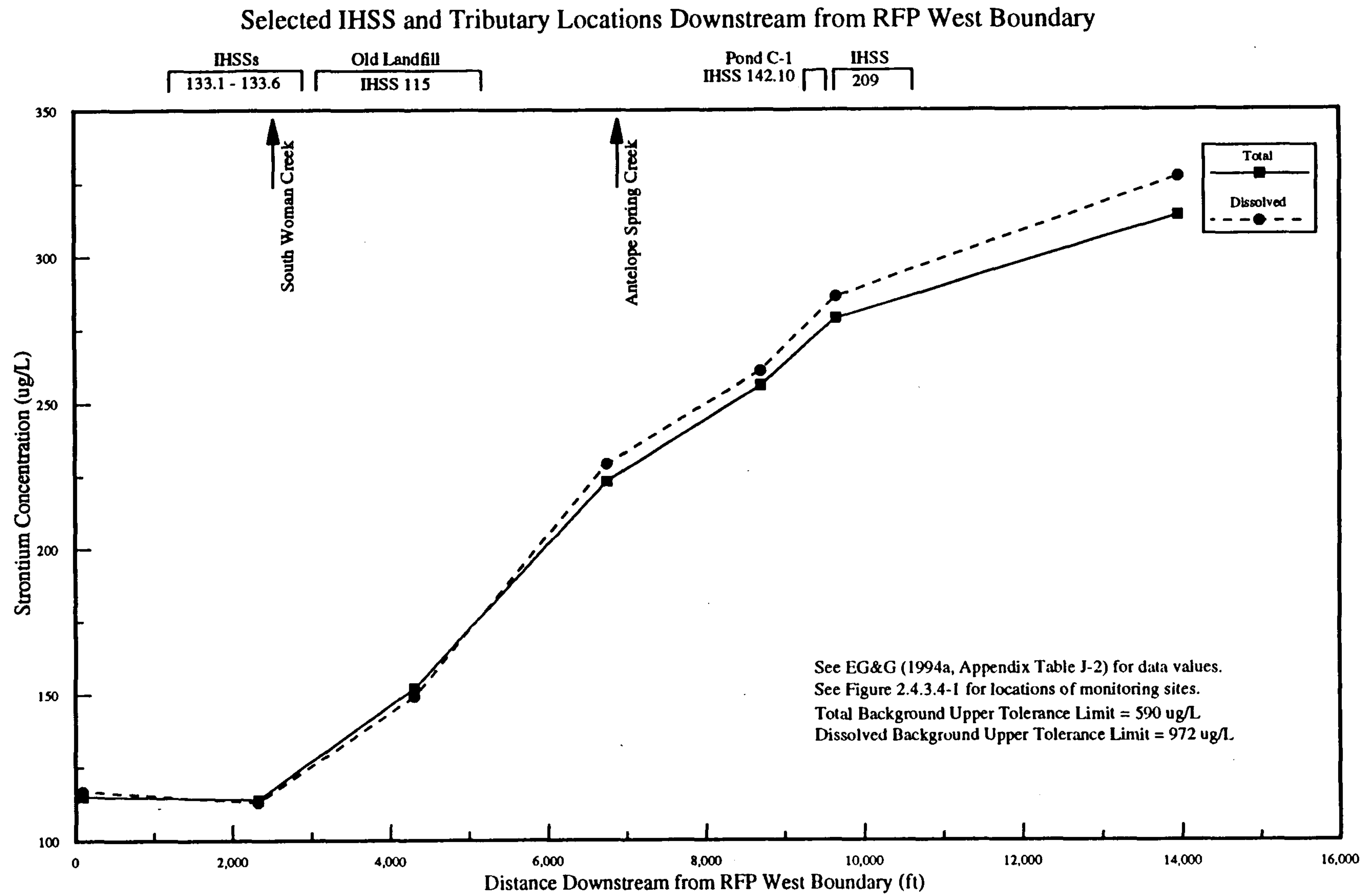
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-2L

FILE: F2434-2L.DRW

Status: 04/20/94



Surface-Water Strontium Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 4, 1992

DRAWN TB 5/11/94	DATE
CHECKED [illegible] 5/11/94	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

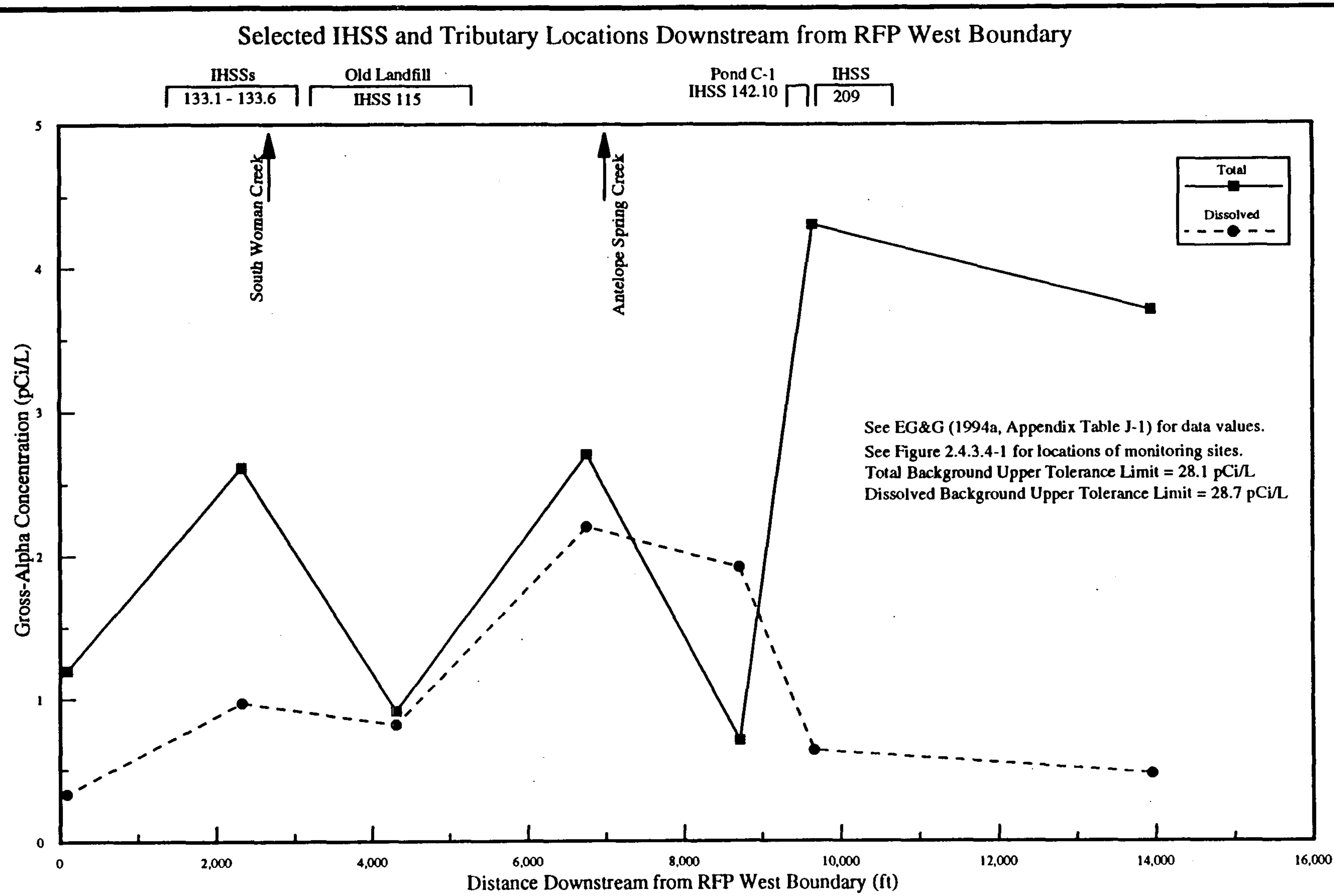
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-2M

FILE: F2434-2M.DRW

Status: 04/20/94



Surface-Water Gross-Alpha Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, March 24, 1993

EG&G

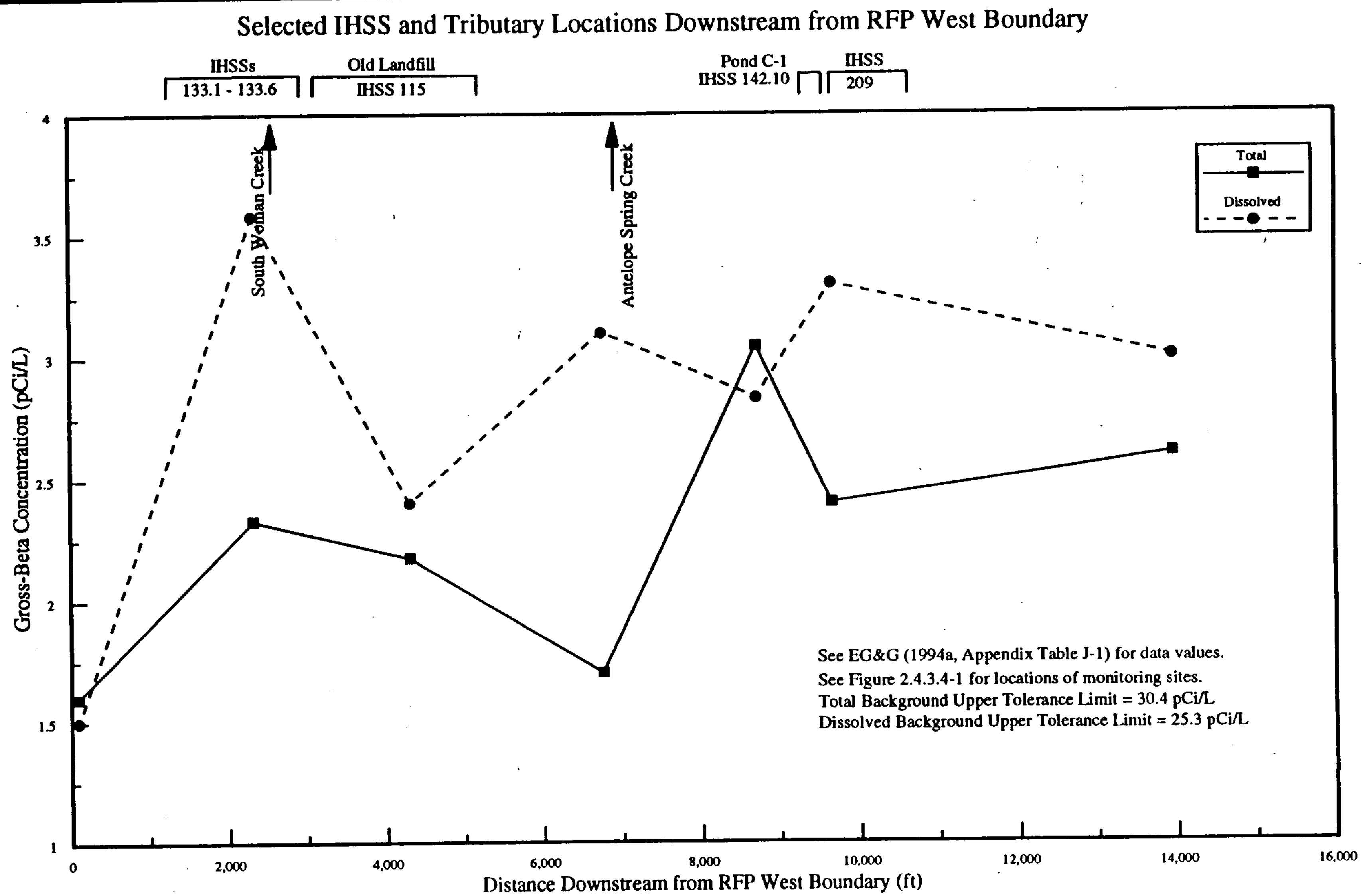
RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-3A

DRAWN TS 5/11/94 DATE
CHECKED 5/11/94 DATE
APPROVED EG&G DATE
APPROVED DOE DATE

FILE: F2434-3A.DRW

Status: 04/20/94



Surface-Water Gross-Beta Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, March 24, 1993

EG&G

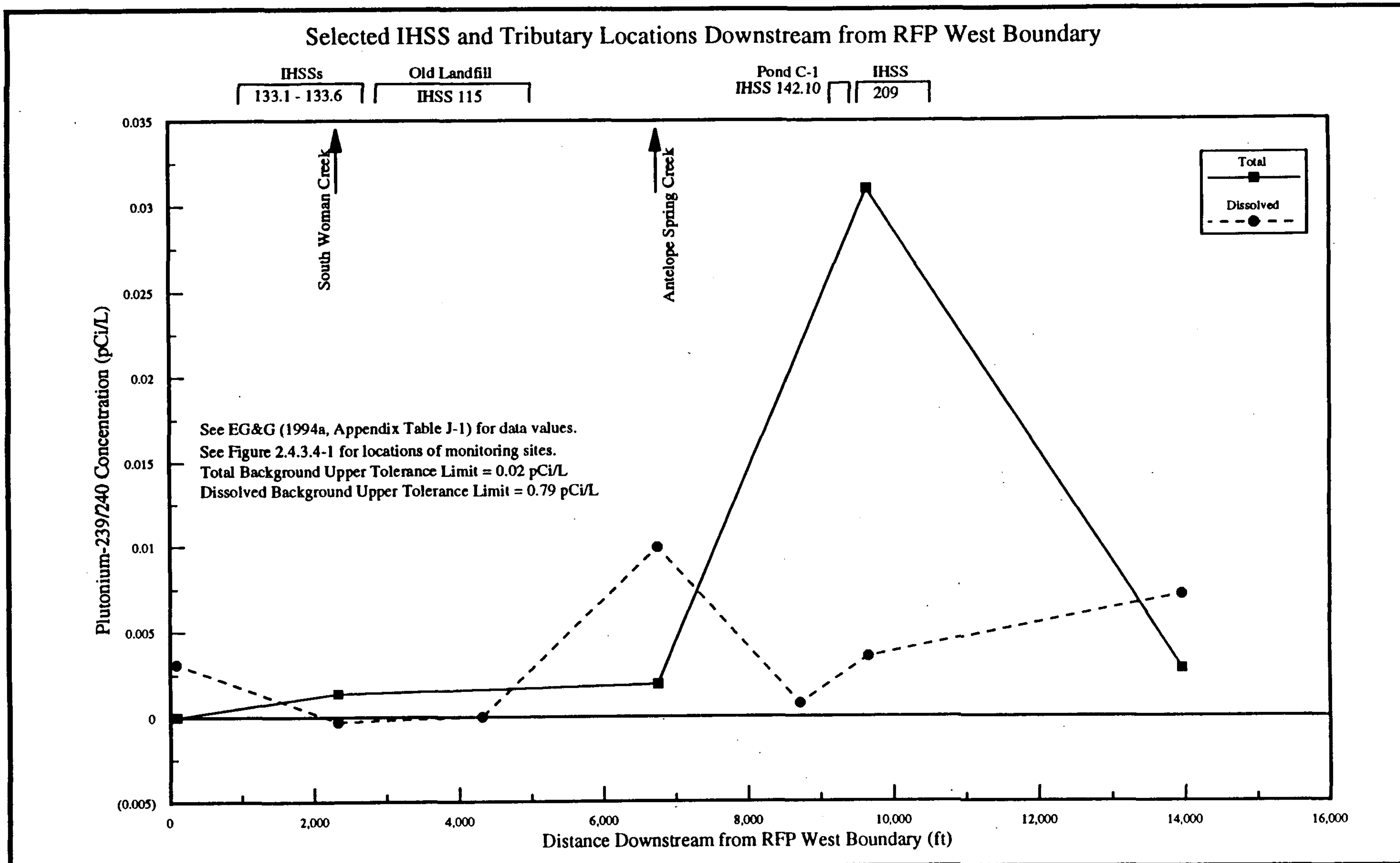
RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-3B

DRAWN TS 5/11/94 DATE
CHECKED TJ 5/11/94 DATE
APPROVED EG&G ____ DATE
APPROVED DOE ____ DATE

Status: 04/20/94

FILE: F2434-3B.DRW



Surface-Water Plutonium-239/240 Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, March 24, 1993

DRAWN TO 5/11/94	DATE
CHECKED 7/7 5/11/94	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

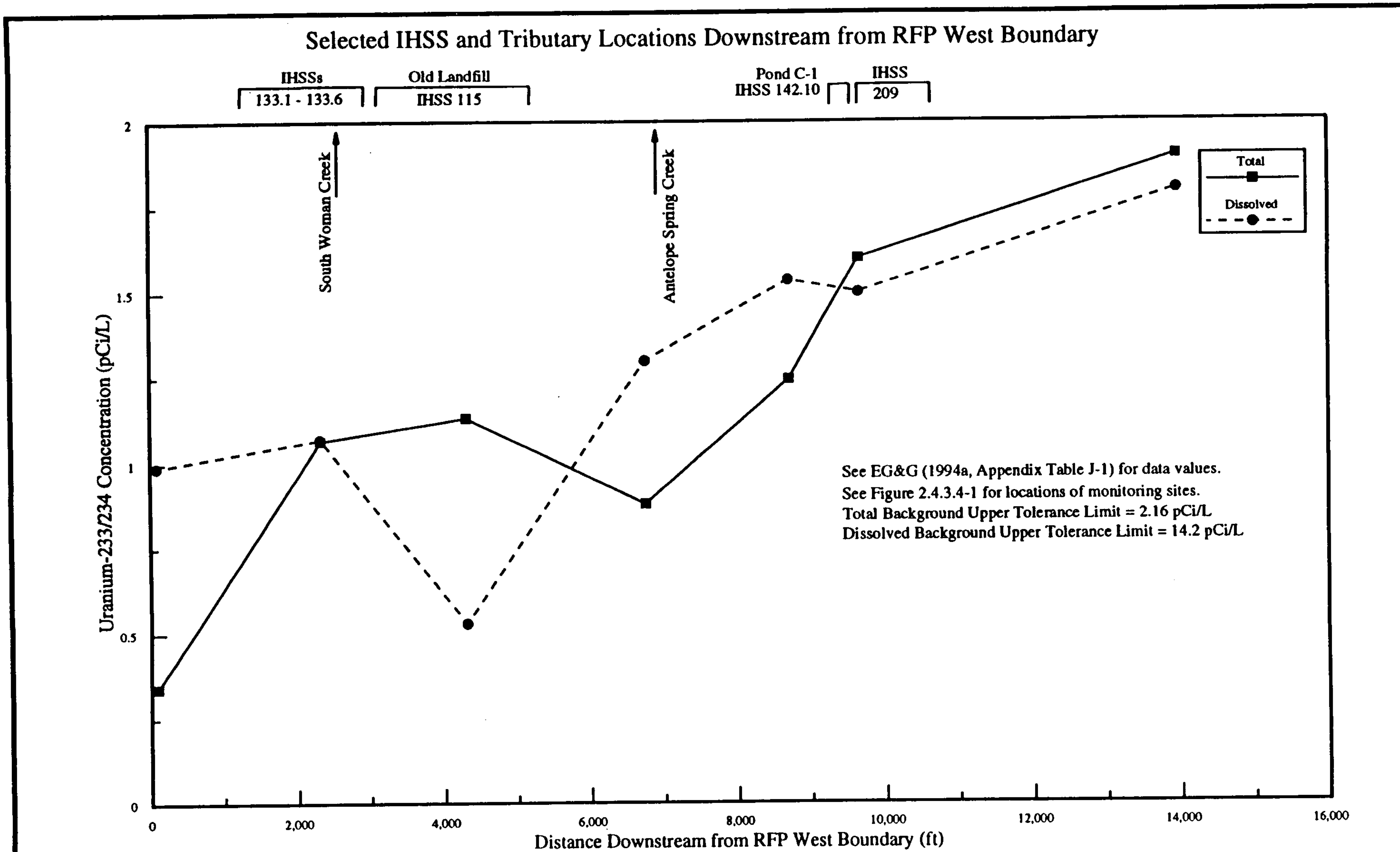
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-3C

FILE: F2434-3C.DRW

Status: 04/20/94



Surface-Water Uranium-233/234 Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, March 24, 1993

DRAWN TB 5/11/94 DATE
CHECKED [illegible] 5/11/94 DATE
APPROVED EG&G DATE
APPROVED DOE DATE

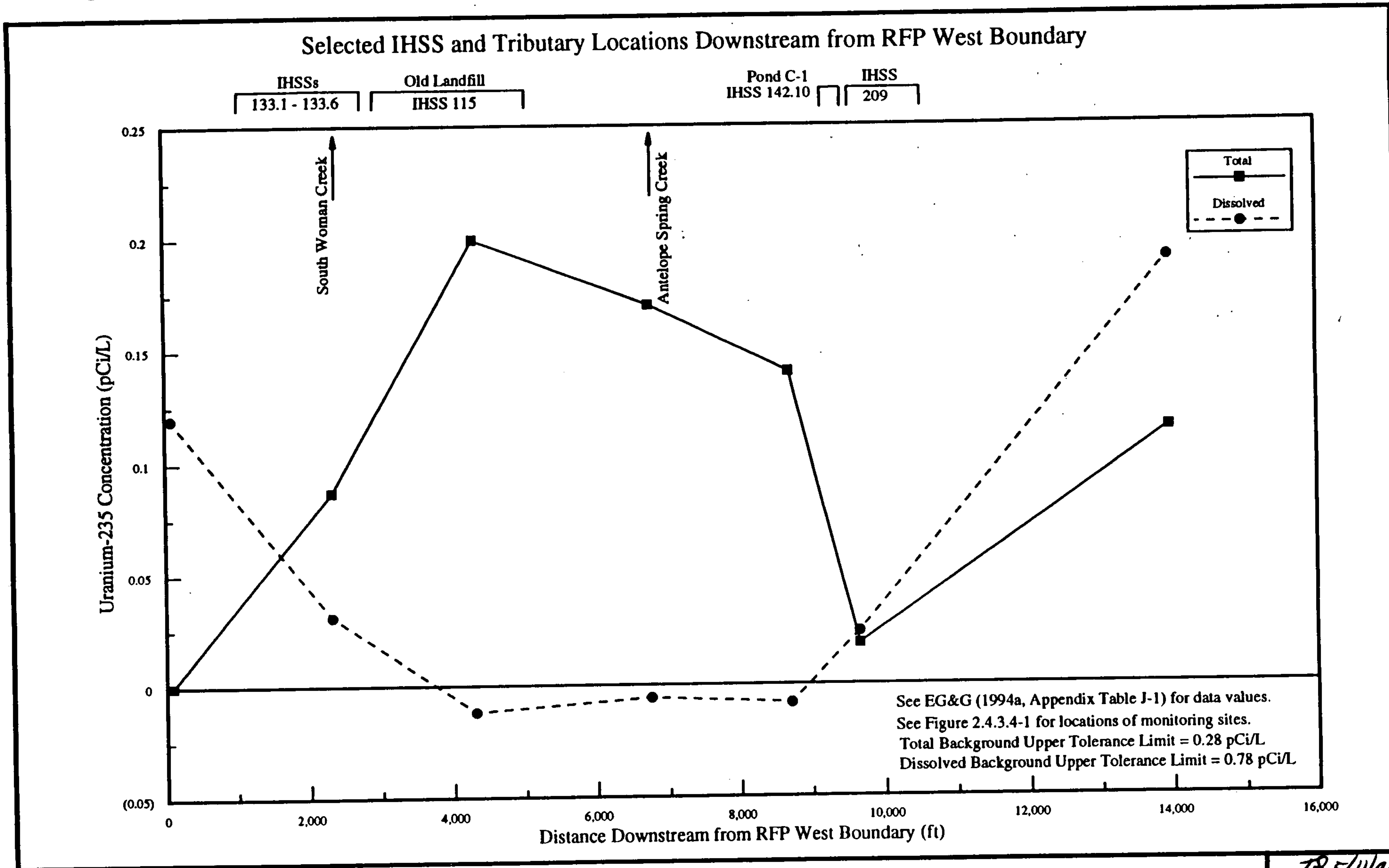
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-3D

FILE: F2434-3D.DRW

Status: 04/20/94



Surface-Water Uranium-235 Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, March 24, 1993

DRAWN TB 5/11/94 DATE
CHECKED TEP 5/11/94 DATE
APPROVED EG&G ____ DATE
APPROVED DOE ____ DATE

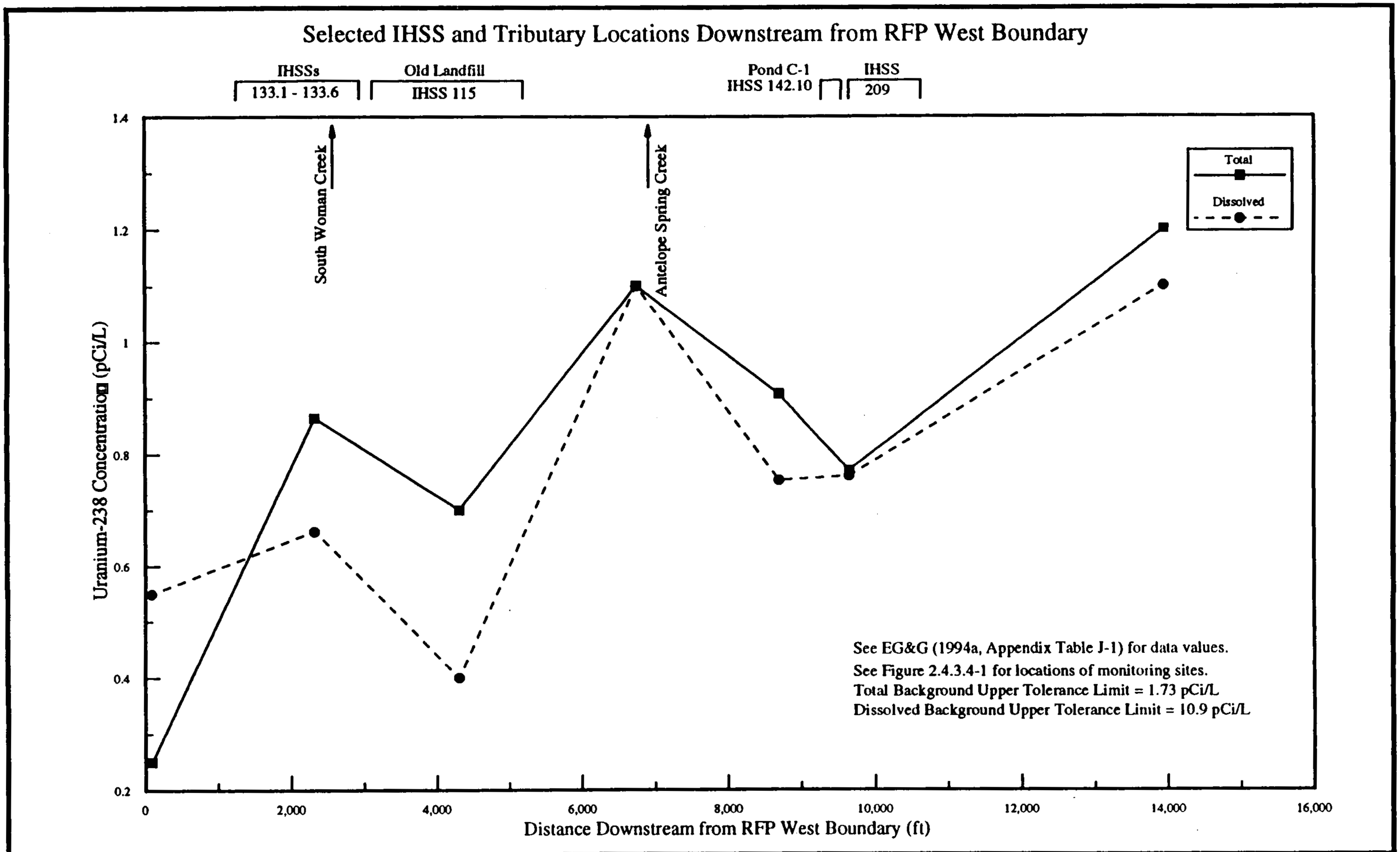
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-3E

FILE: F2434-3E.DRW

Status: 04/20/94



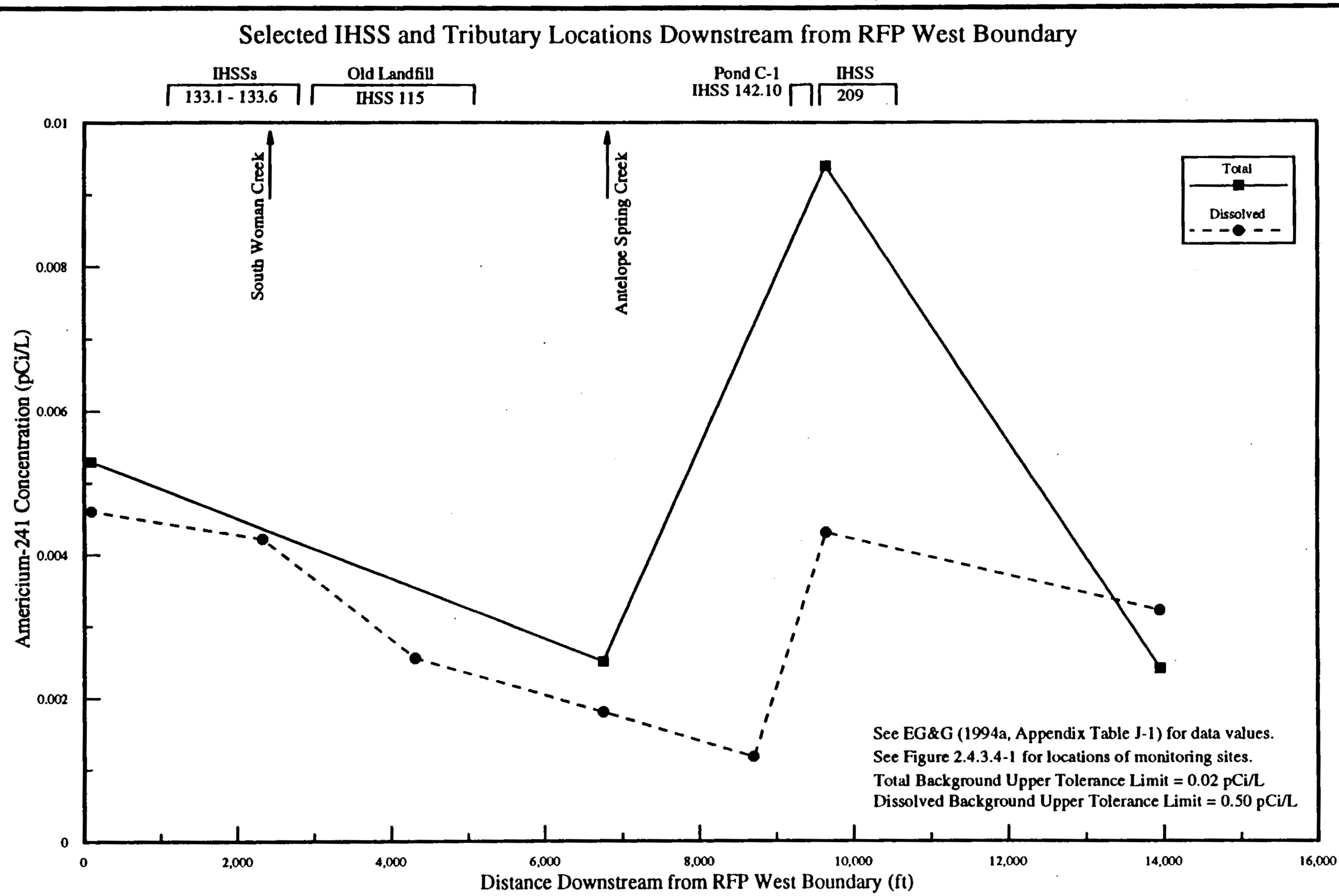
Surface-Water Uranium-238 Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, March 24, 1993

EG&G	RFP, OU5 RFI/RI, TM15 WOMAN CREEK PRIORITY DRAINAGE	FIGURE 2.4.3.4-3F

DRAWN TR 5/11/94 DATE
CHECKED 5/11/94 JZ DATE
APPROVED EG&G ______ DATE
APPROVED DOE ______ DATE

FILE: F2434-3F.DRW

Status: 04/20/94



Surface-Water Americium-241 Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, March 24, 1993

DRAWN TD 5/11/94	DATE
CHECKED TJP 5/11/94	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

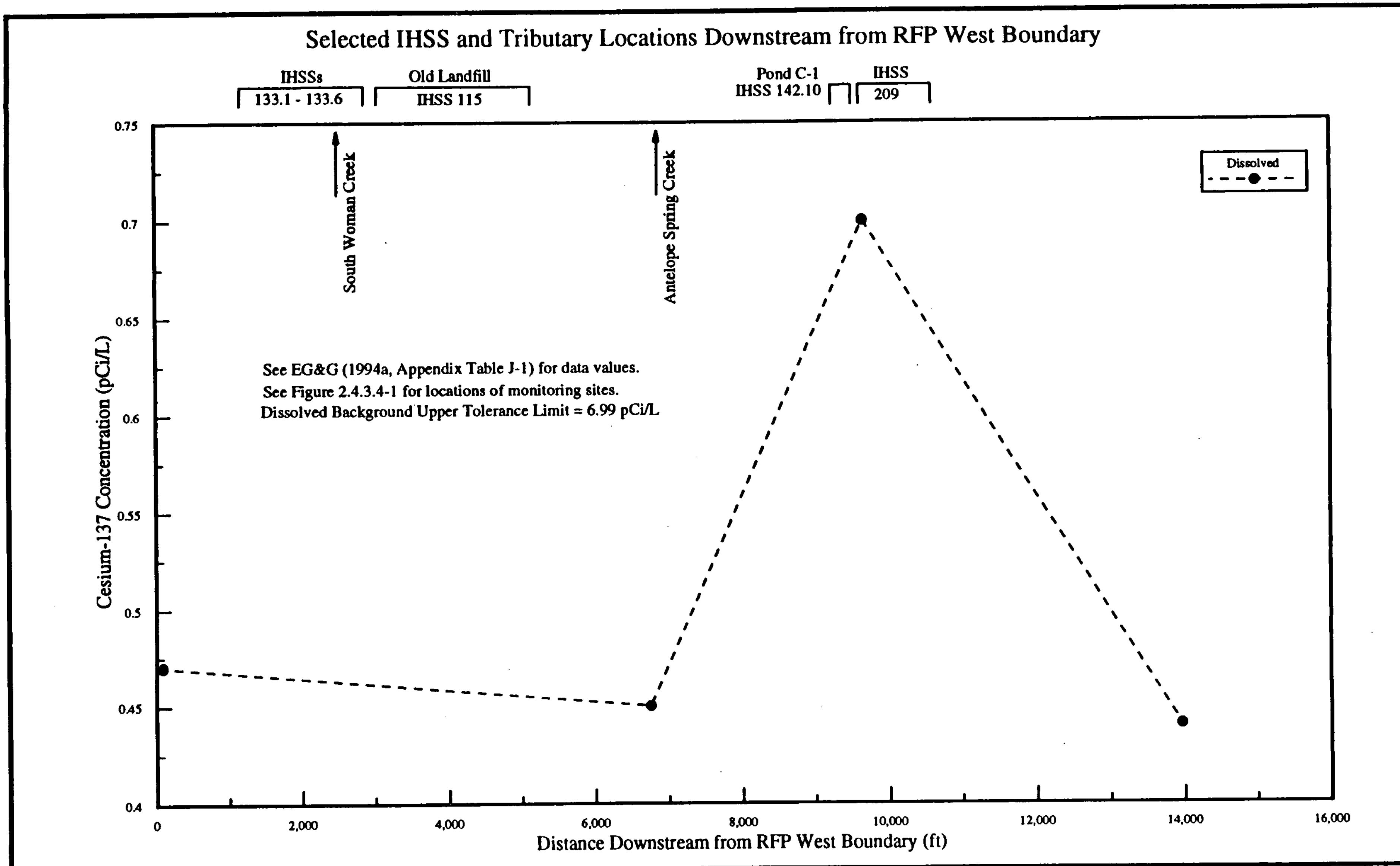
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-3G

FILE: F2434-3G.DRW

Status: 04/20/94



Surface-Water Cesium-137 Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, March 24, 1993

EG&G

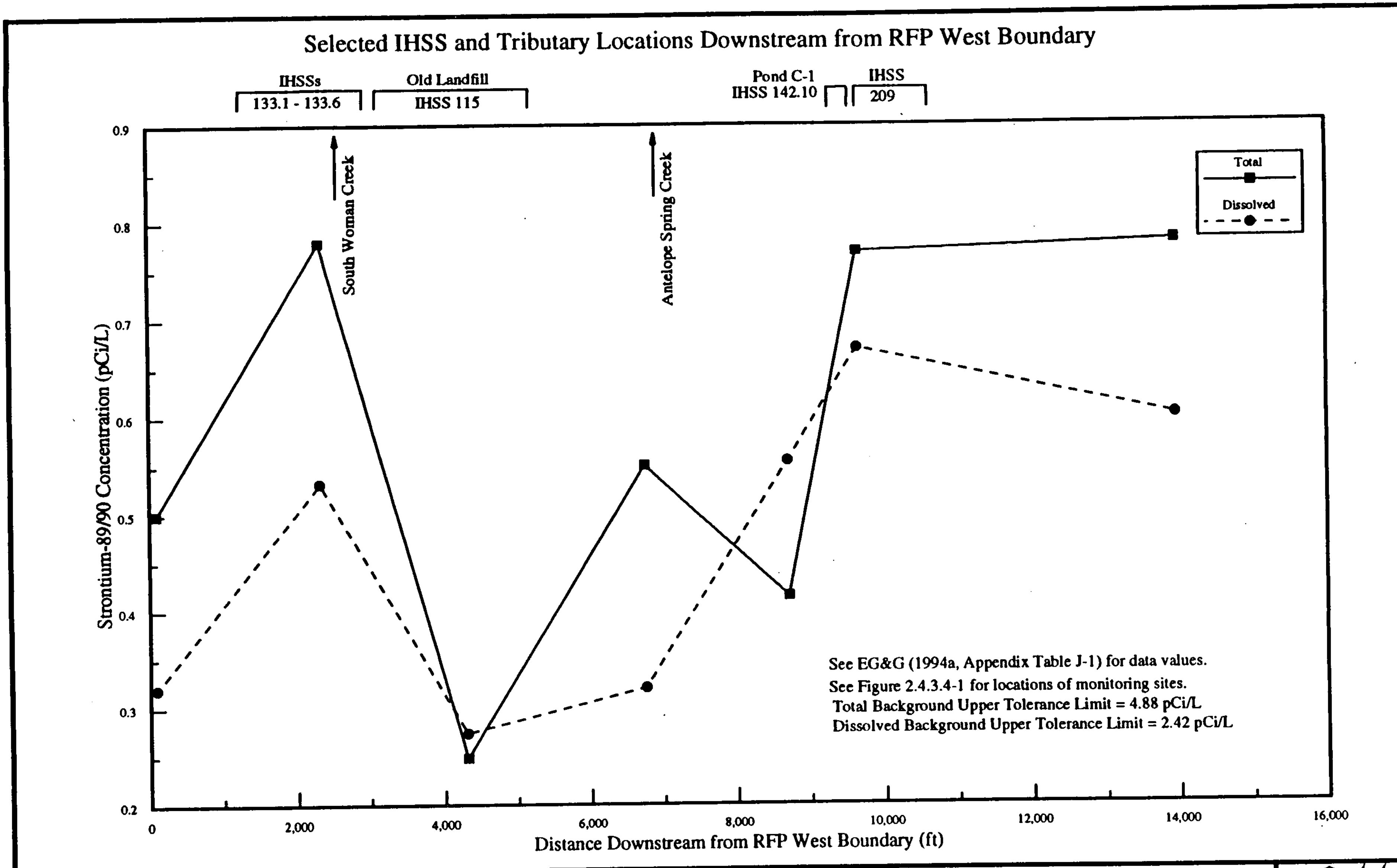
RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-3H

DRAWN TR 5/11/94 DATE
CHECKED TJ 5/11/94 DATE
APPROVED EG&G DATE
APPROVED DOE DATE

FILE: F2434-3H.DRW

Status: 04/20/94



Surface-Water Strontium-89/90 Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, March 24, 1993

DRAWN TP 5/11/94 DATE
CHECKED TP 5/11/94 DATE
APPROVED EG&G ____ DATE
APPROVED DOE ____ DATE

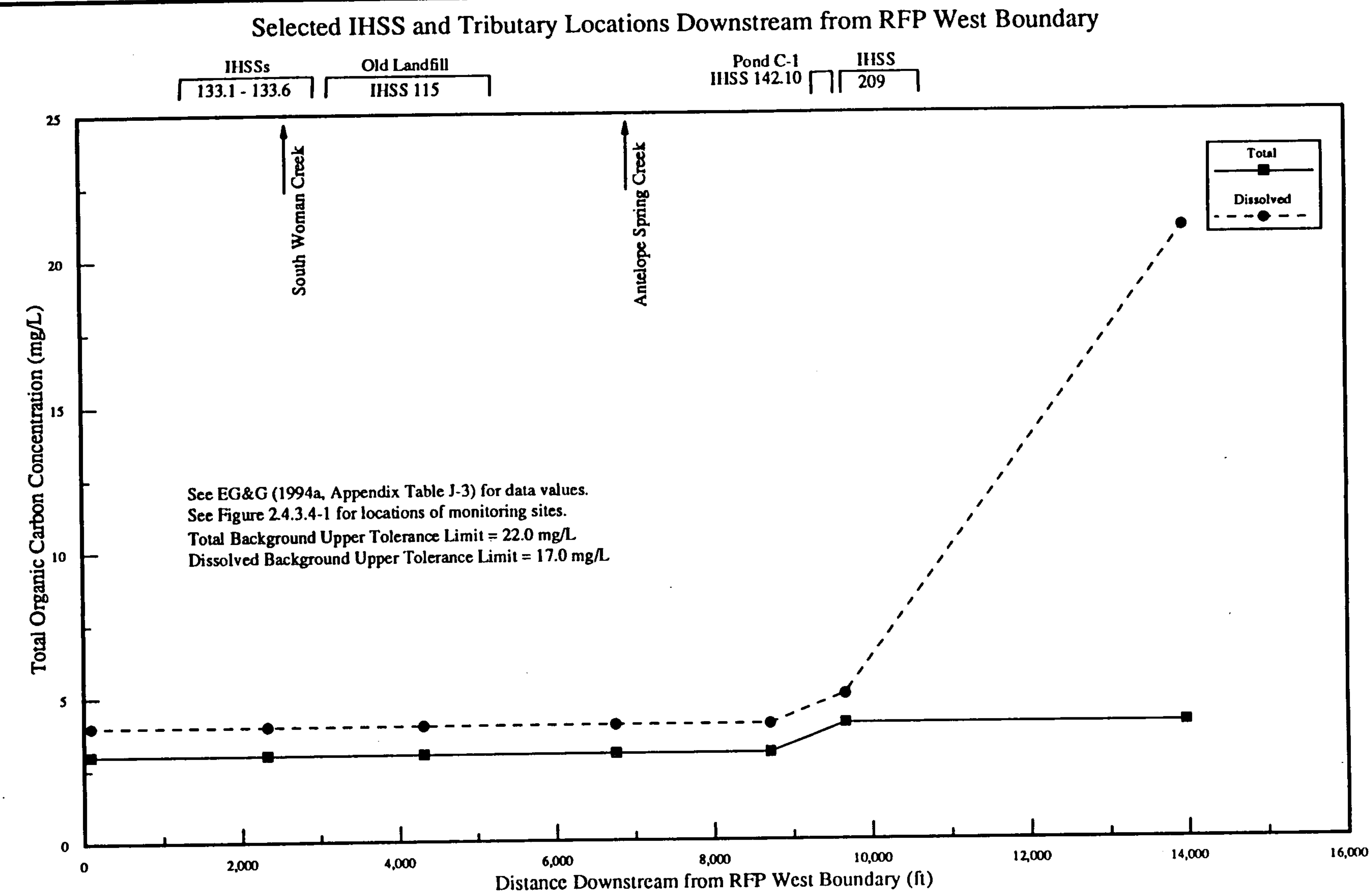
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-31

Status: 04/20/94

FILE: F2434-31.DRW



Surface-Water Total Organic Carbon Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, March 24, 1993

DRAWN TR 5/11/94	DATE
CHECKED 5/11/94	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

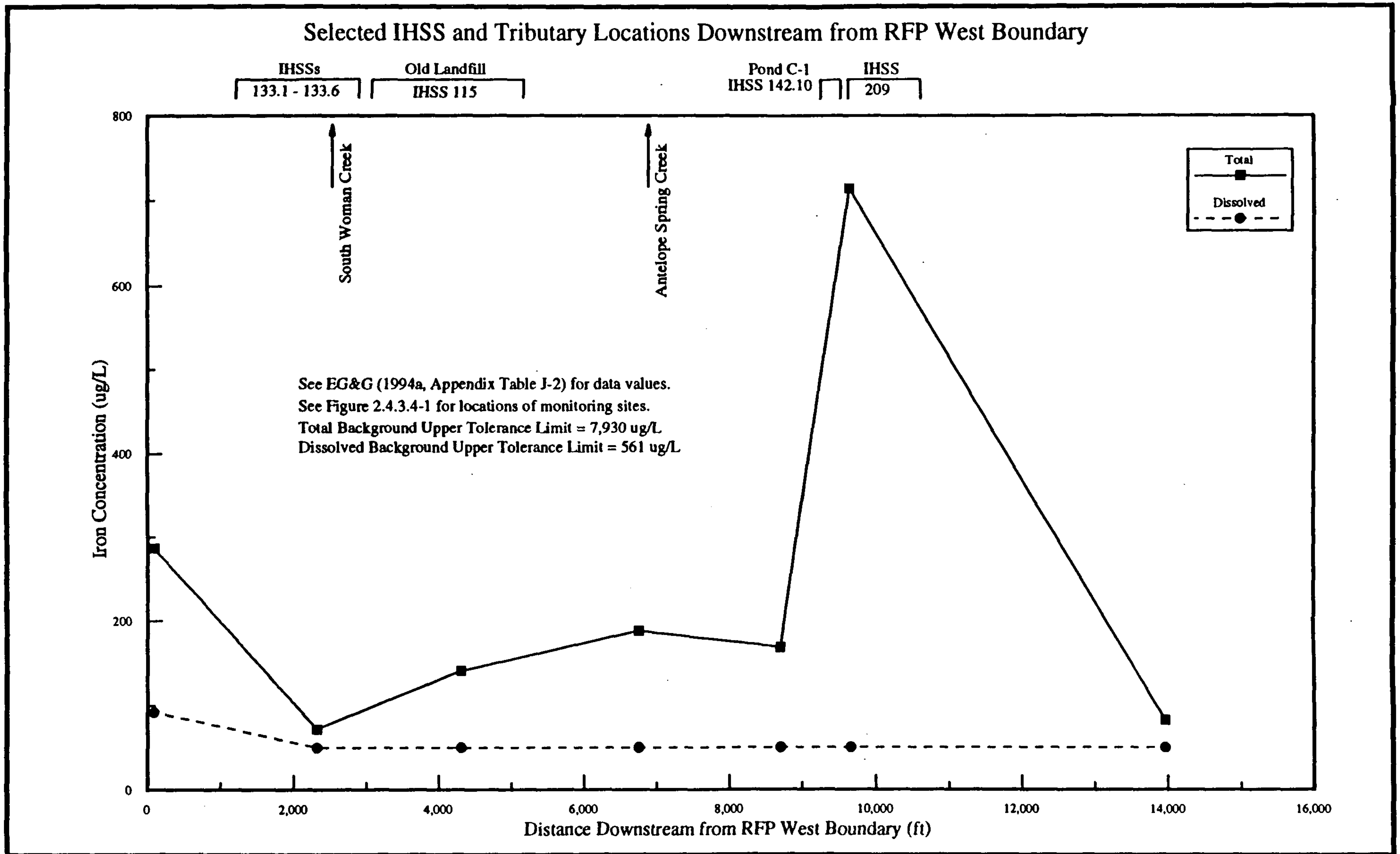
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-3J

Status: 04/20/94

FILE: F2434-3J.DRW



Surface-Water Iron Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, March 24, 1993

EG&G

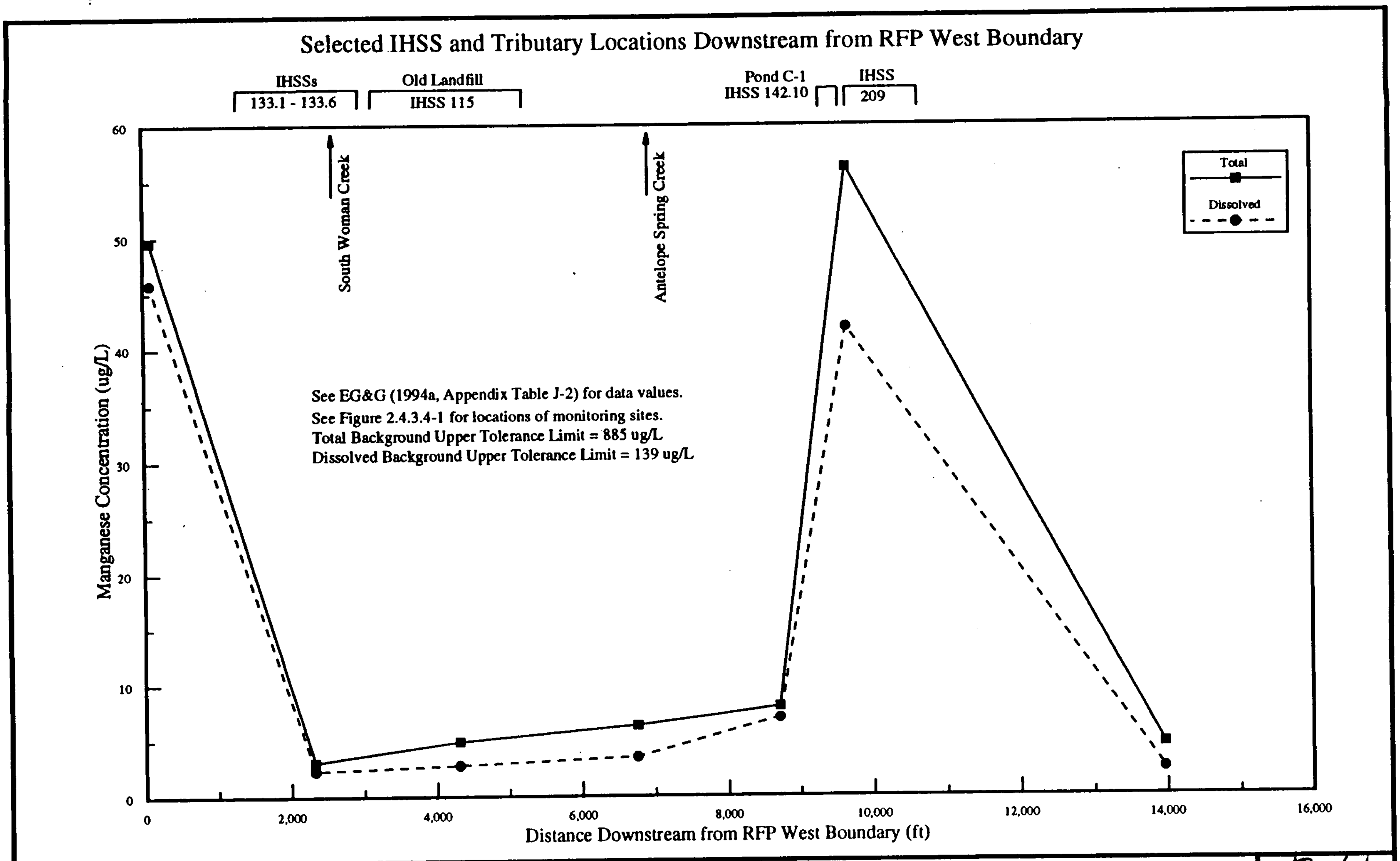
RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-3K

DRAWN TR 5/11/94 DATE
CHECKED TR 5/11/94 DATE
APPROVED EG&G ____ DATE
APPROVED DOE ____ DATE

FILE: F2434-3K.DRW

Status: 04/20/94



Surface-Water Manganese Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, March 24, 1993

DRAWN TD 5/11/94 DATE
CHECKED [signature] 5/11/94 DATE
APPROVED EG&G ______ DATE
APPROVED DOE ______ DATE

EG&G

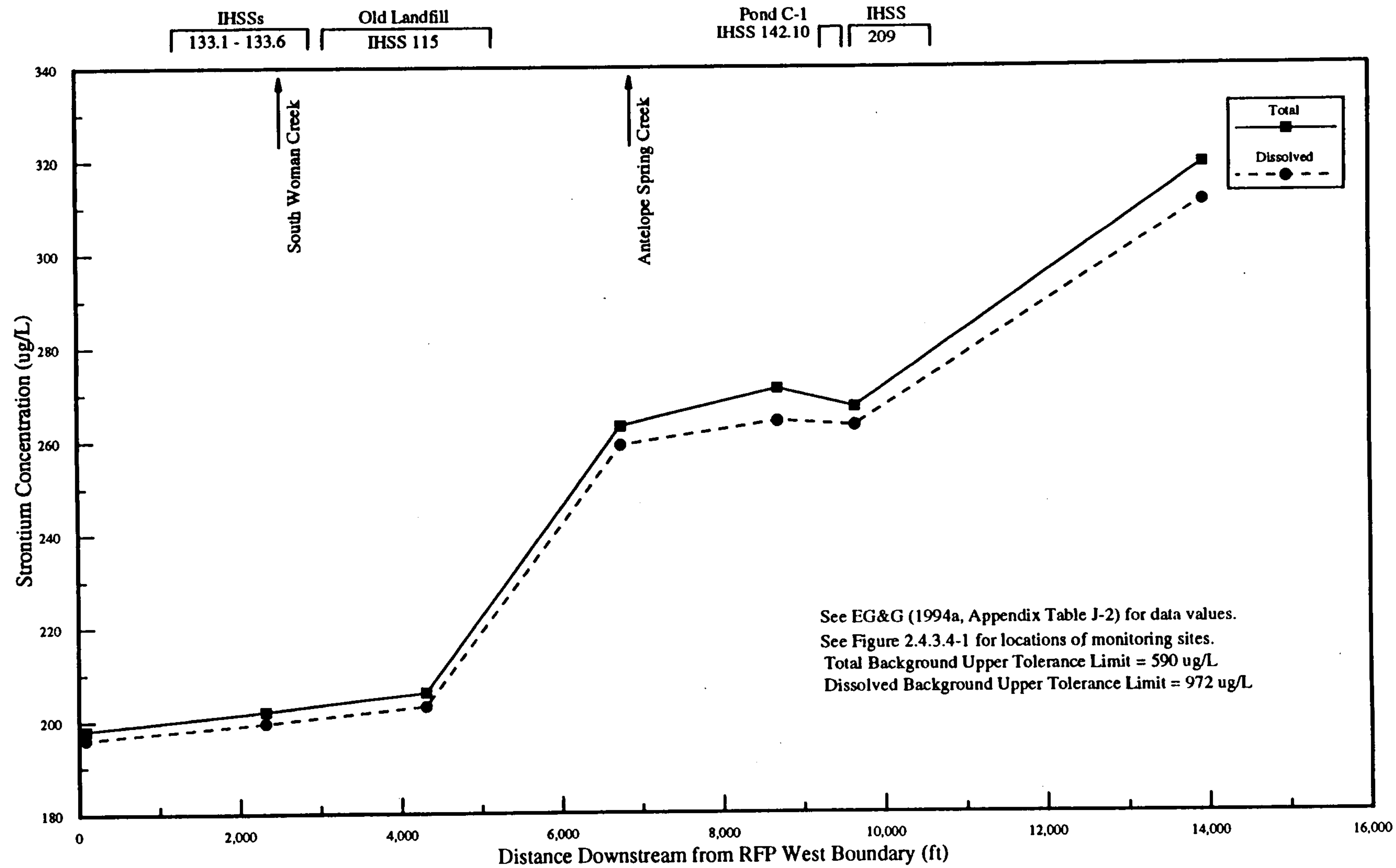
RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-3L

FILE: F2434-3L.DRW

Status: 04/20/94

Selected IHSS and Tributary Locations Downstream from RFP West Boundary



Surface-Water Strontium Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, March 24, 1993

EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

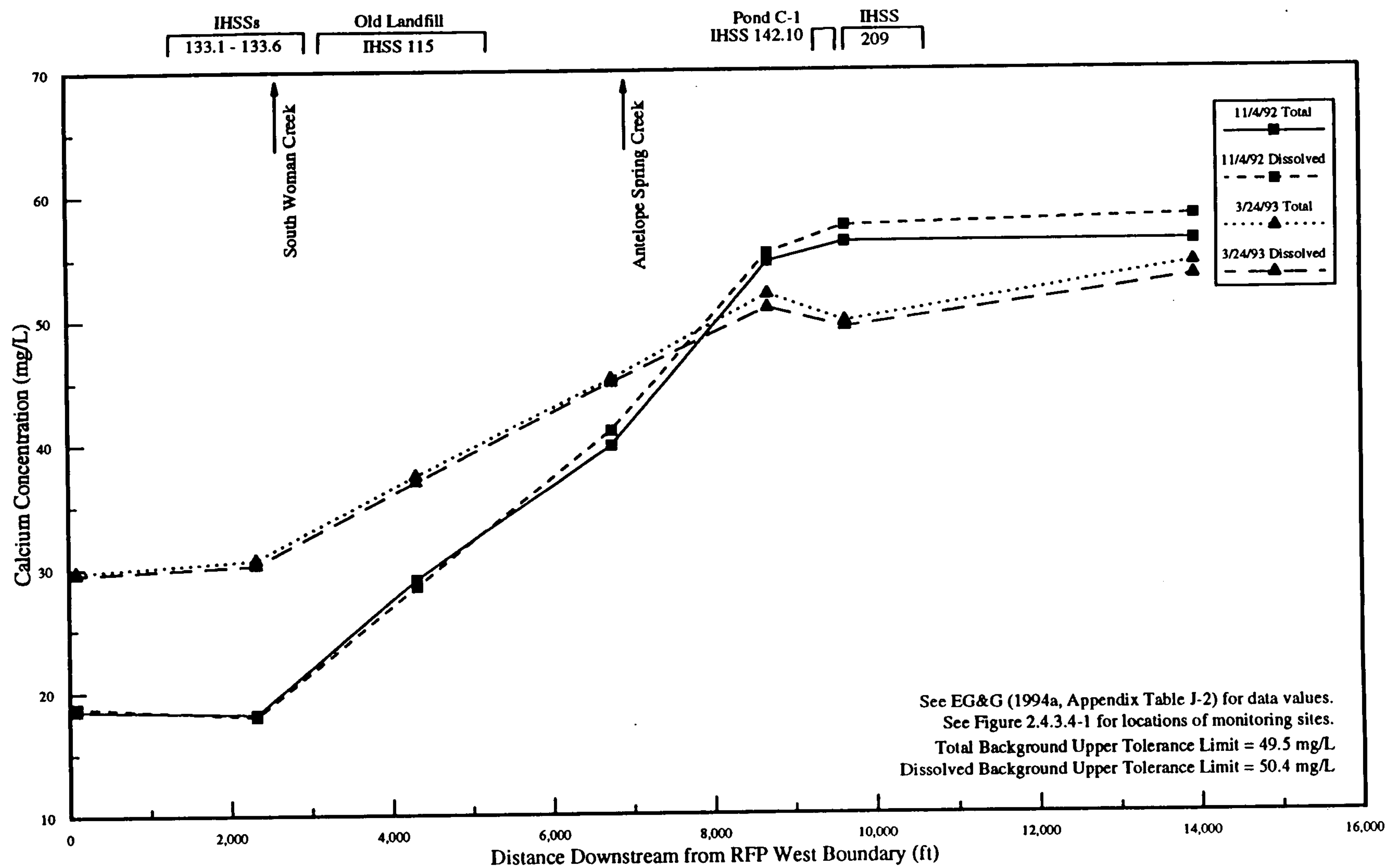
FIGURE 2.4.3.4-3M

DRAWN 5/11/94 DATE
CHECKED 5/11/94 DATE
APPROVED EG&G DATE
APPROVED DOE DATE

FILE: F2434-3M.DRW

Status: 04/20/94

Selected IHSS and Tributary Locations Downstream from RFP West Boundary



Surface-Water Calcium Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey

DRAWN 5/11/94	DATE
CHECKED	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

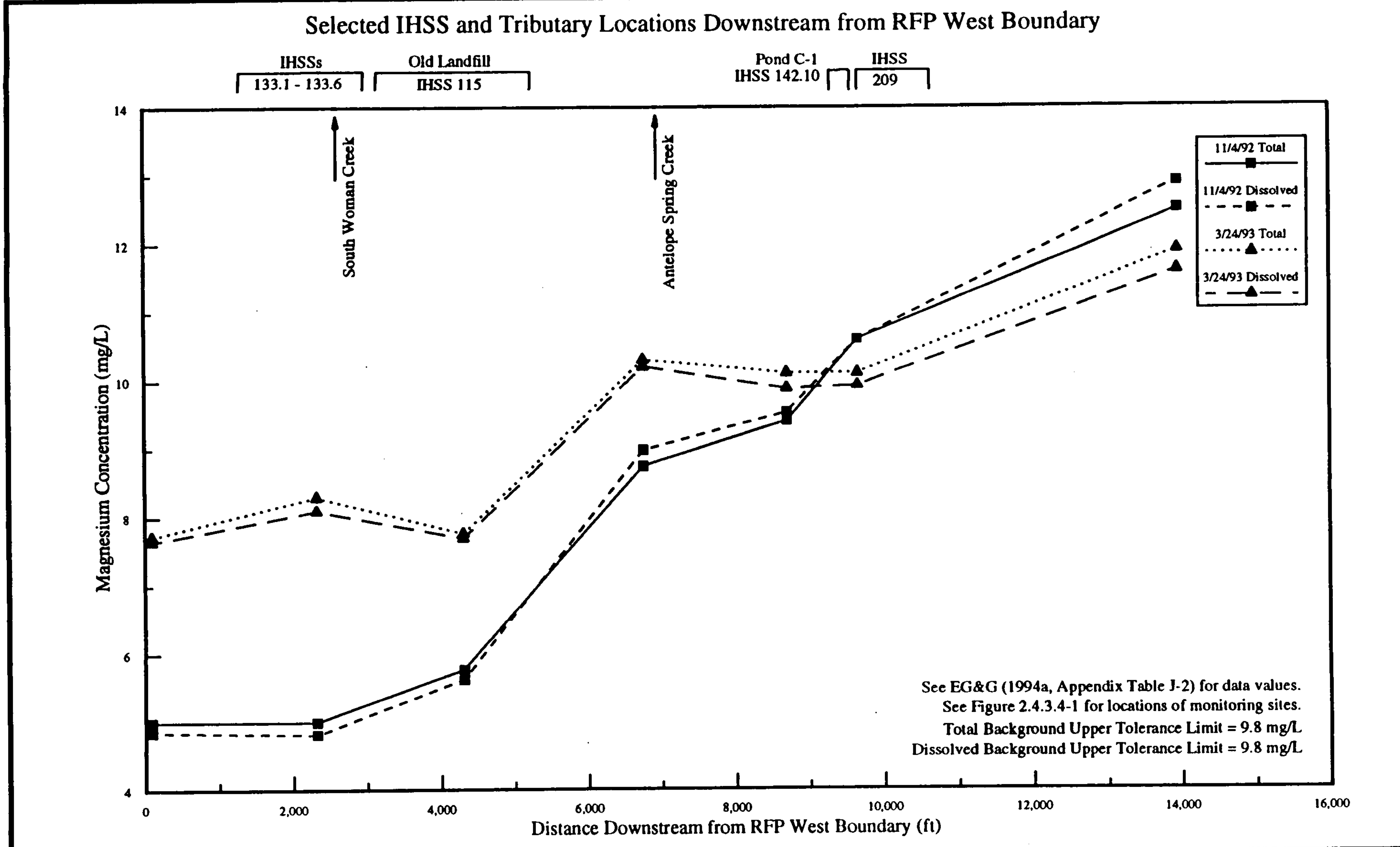
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-4A

Status: 04/20/94

FILE: F2434-4A.DRW



Surface-Water Magnesium Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey

DRAWN TL 5/11/94	DATE
CHECKED TL 5/11/94	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

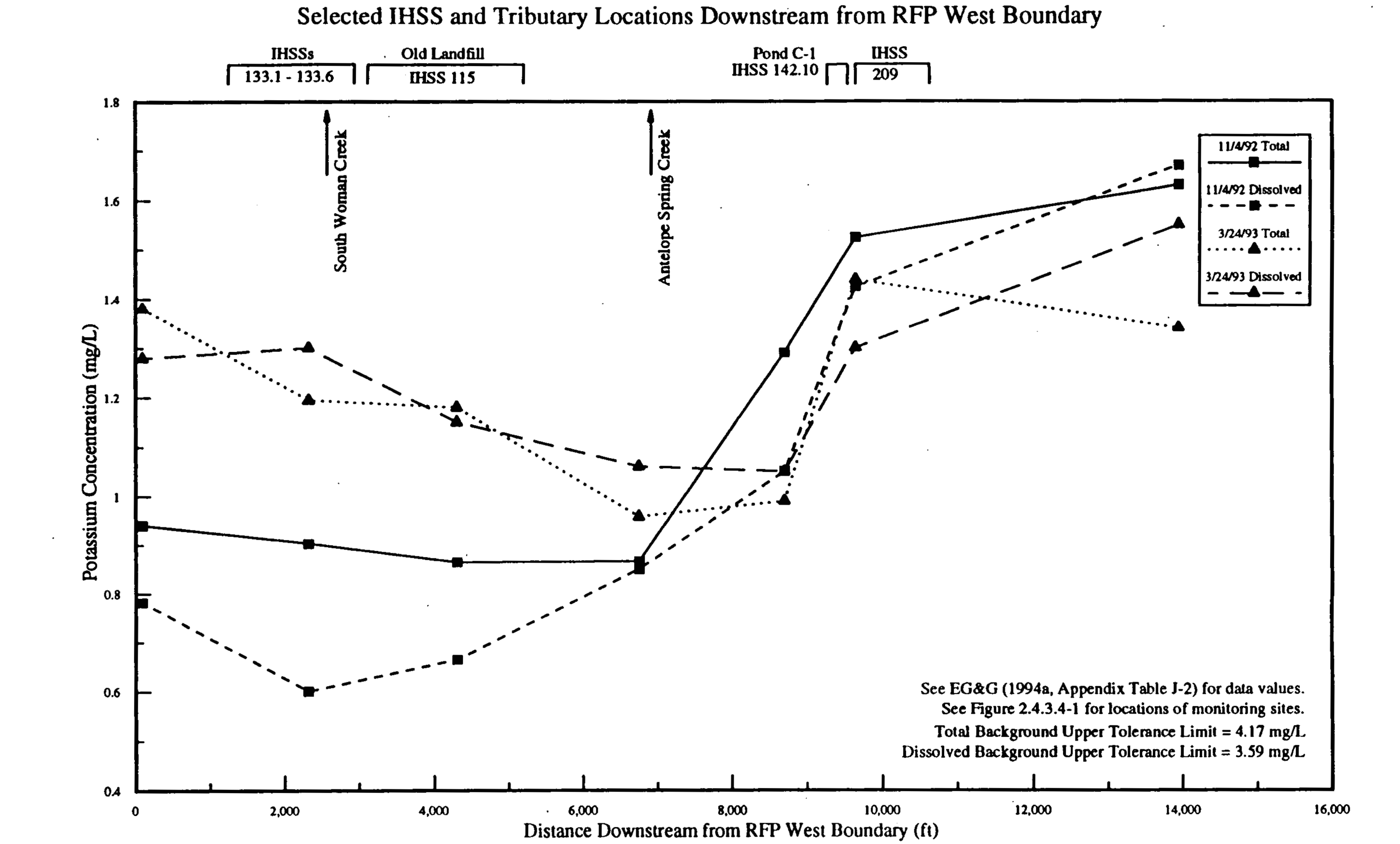
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-4B

FILE: F2434-4B.DRW

Status: 04/20/94



Surface-Water Potassium Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey

EG&G

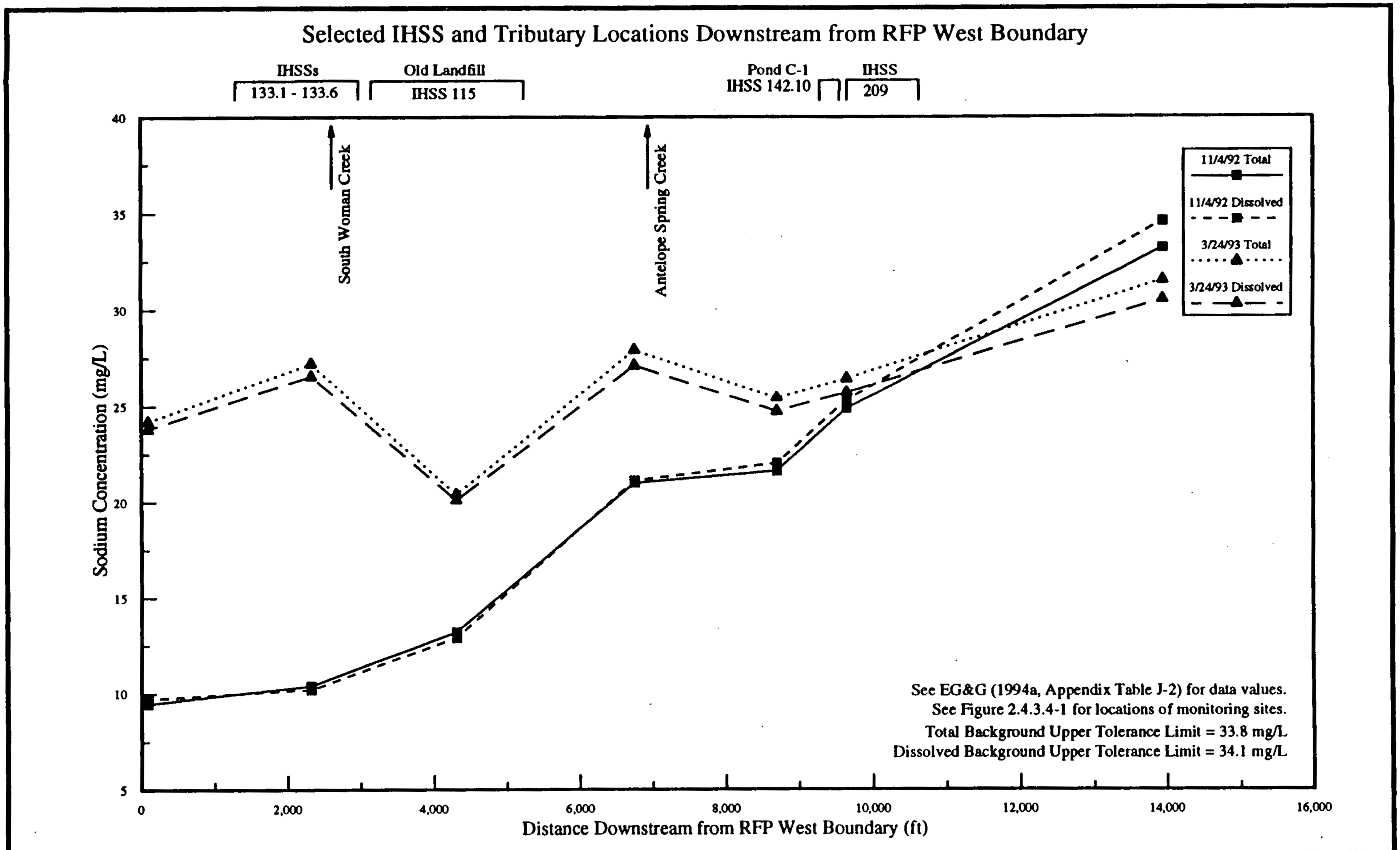
RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-4C

DRAWN TR 5/11/94 DATE
CHECKED 5/11/94 DATE
APPROVED EG&G ____ DATE
APPROVED DOE ____ DATE

FILE: F2434-4C.DRW

Status: 04/20/94



Surface-Water Sodium Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey

DRAWN 5/11/94	DATE
CHECKED 5/11/94	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

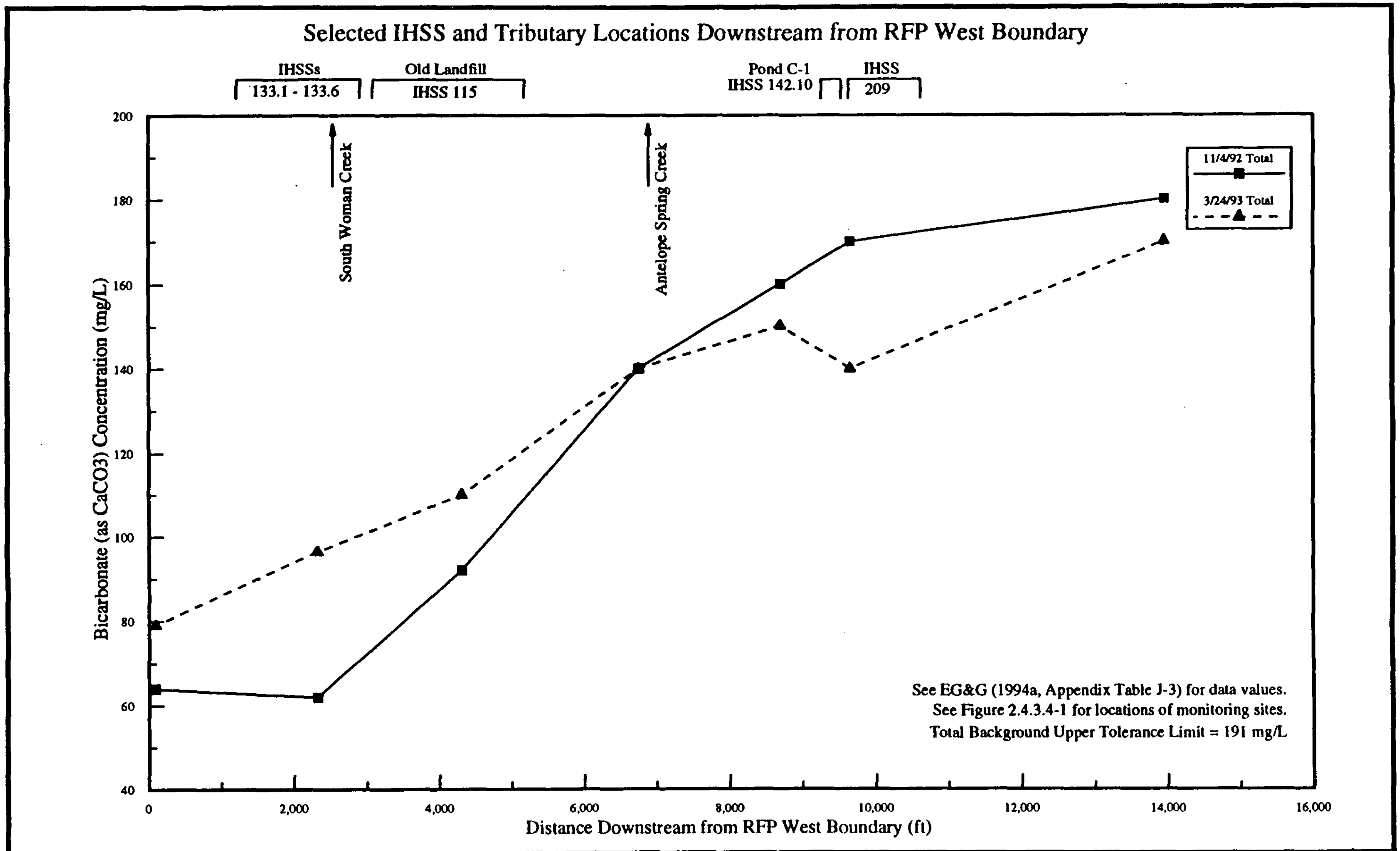
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-4D

FILE: F2434-4D.DRW

Status: 04/20/94



Surface-Water Bicarbonate (as $CaCO_3$) Concentrations Vs. Distance in Woman Creek
Low-Flow Sampling Survey

DRAWN TL 5/11/94	DATE
CHECKED 5/11/94	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

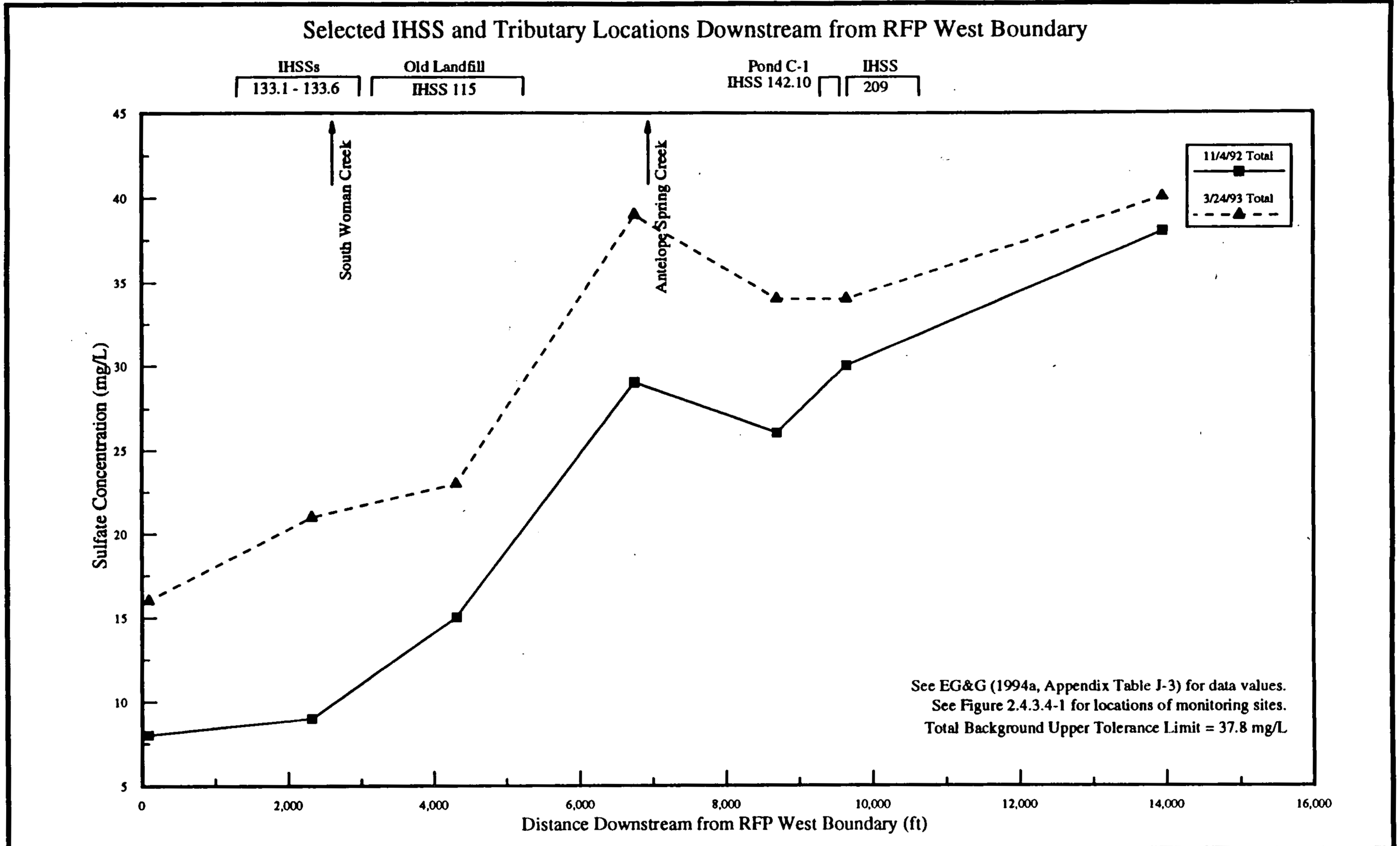
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-4E

FILE: F2434-4E.DRW

Status: 04/20/94



Surface-Water Sulfate Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey

DRAWN TB 5/11/94 DATE
CHECKED TZ? 5/11/94 DATE
APPROVED EG&G DATE
APPROVED DOE DATE

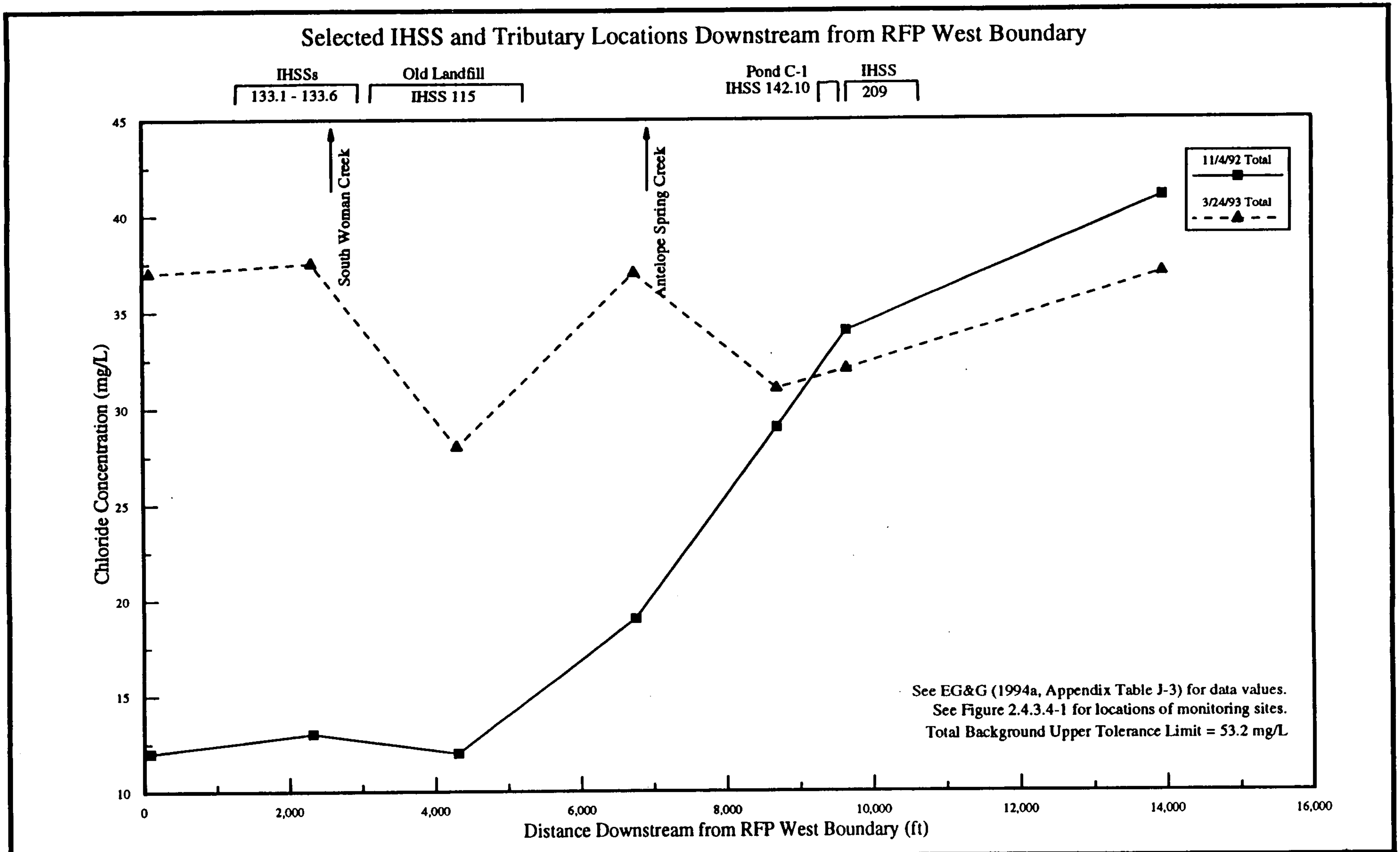
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-4F

FILE: F2434-4F.DRW

Status: 04/20/94



Surface-Water Chloride Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey

EG&G

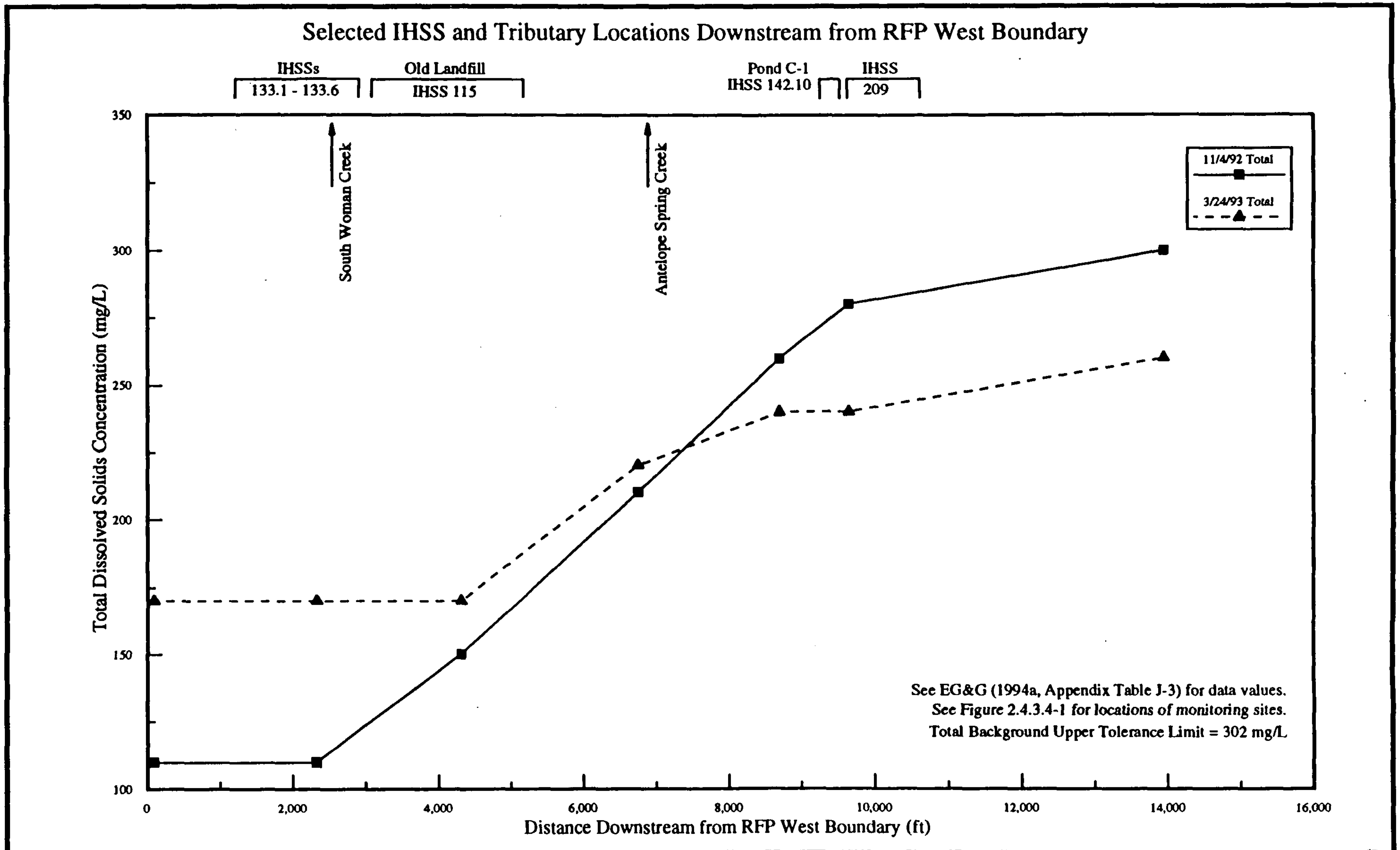
RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-4G

DRAWN TR 5/11/94 DATE
CHECKED TR 5/11/94 DATE
APPROVED EG&G ____ DATE
APPROVED DOE ____ DATE

FILE: F2434-4G.DRW

Status: 04/20/94



Surface-Water Total Dissolved Solids Concentrations Vs. Distance in Woman Creek
Low-Flow Sampling Survey

DRAWN TJ DATE 5/11/94	CHECKED TJ DATE 5/11/94	APPROVED EG&G ____ DATE
APPROVED DOE ____ DATE		

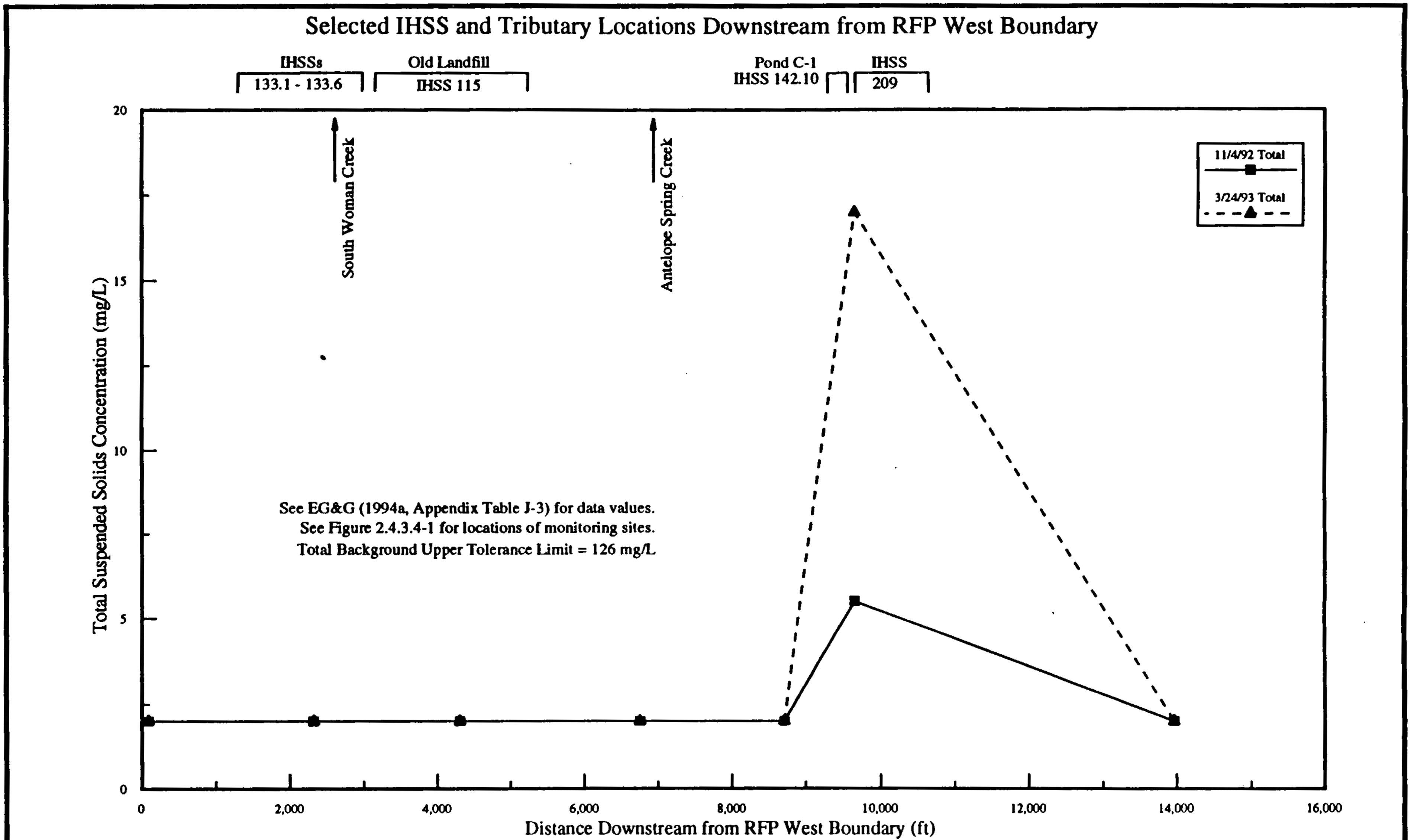
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-4H

FILE: F2434-4H.DRW

Status: 04/20/94



Surface-Water Total Suspended Solids Concentrations Vs. Distance in Woman Creek
Low-Flow Sampling Survey

DRAWN TR 5/11/94	DATE
CHECKED [illegible]	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

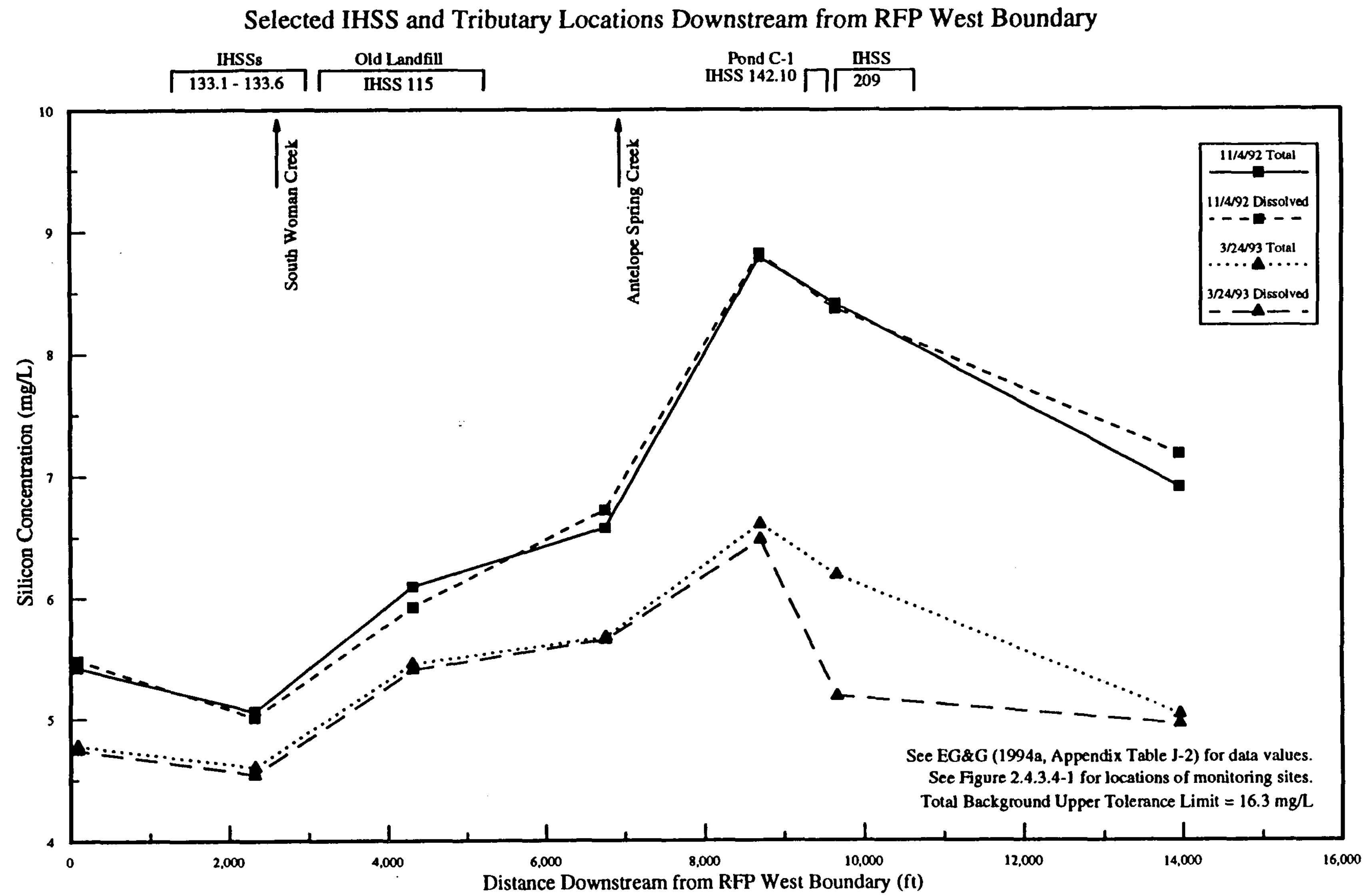
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-4I

FILE: F2434-4I.DRW

Status: 04/20/94



Surface-Water Silicon Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey

DRAWN TR 5/11/94	DATE
CHECKED	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

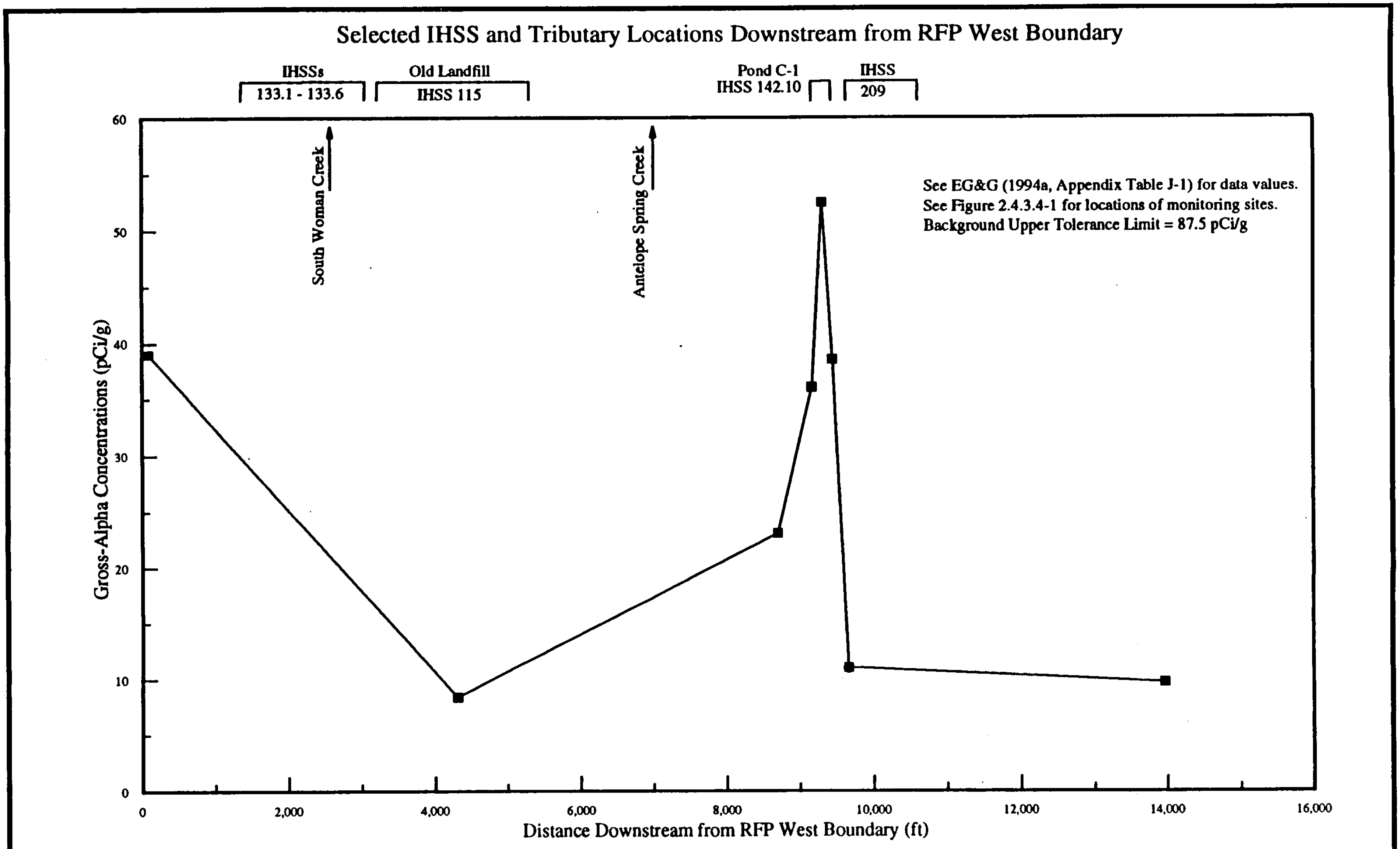
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-4J

FILE: F2434-4J.DRW

Status: 04/20/94



Bottom-Sediment Gross-Alpha Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 5-10, 1992

DRAWN 5/11/94 DATE
CHECKED 5/11/94 DATE
APPROVED EG&G DATE
APPROVED DOE DATE

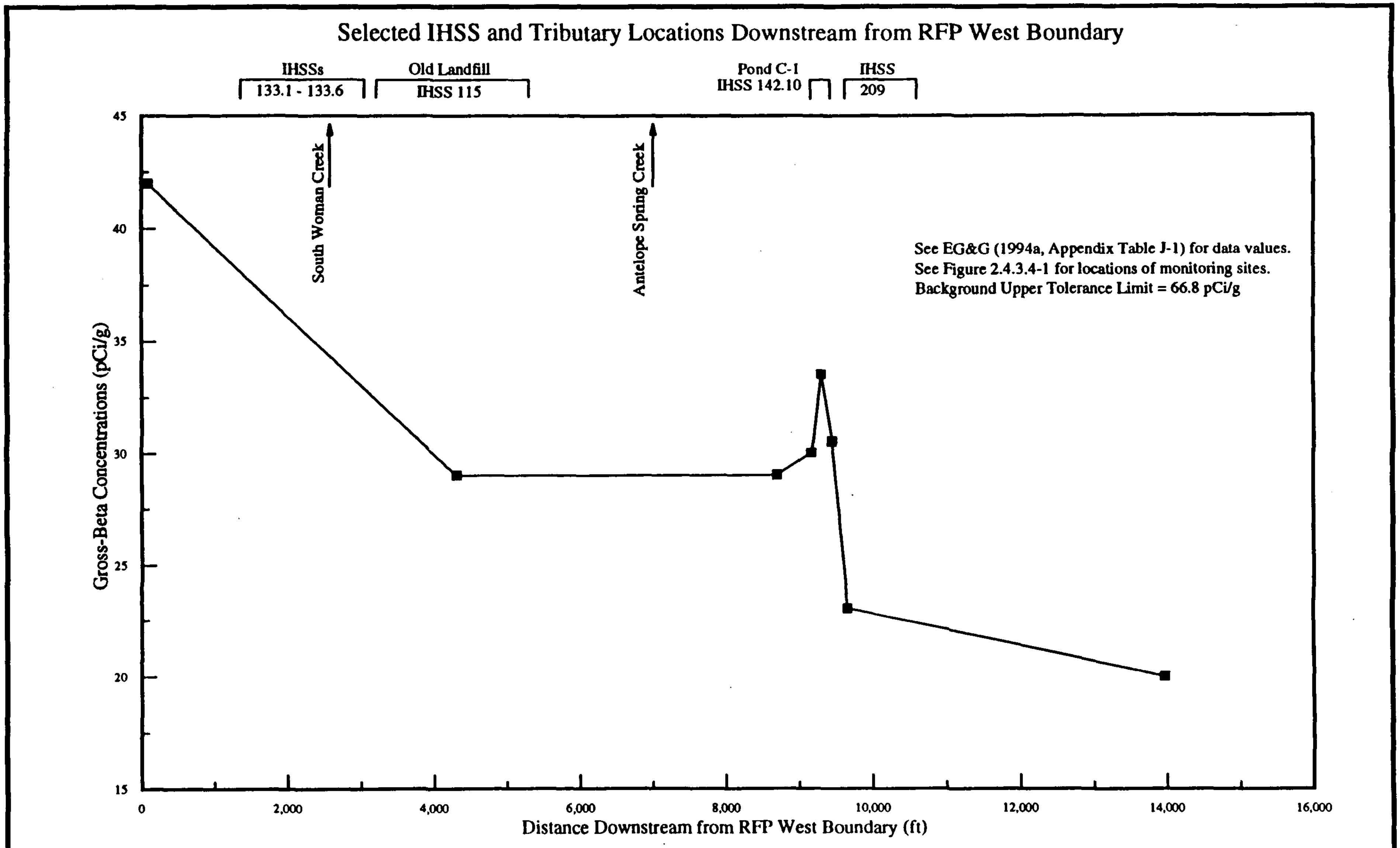
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-5A

FILE: F2434-5A.DRW

Status: 04/20/94



Bottom-Sediment Gross-Beta Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 5-10, 1992

EG&G

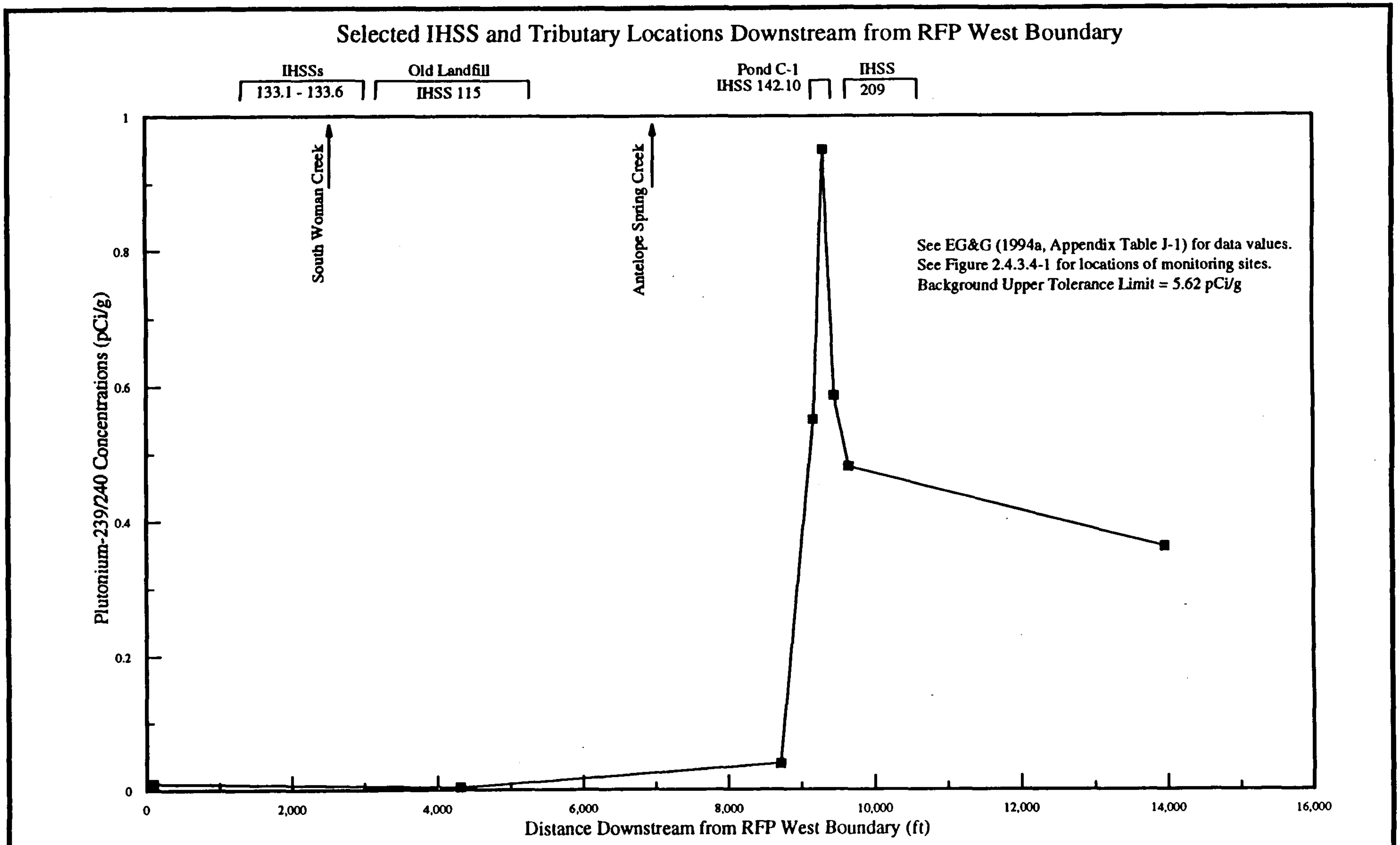
RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-5B

DRAWN TS 8/11/94 DATE
CHECKED DATE
APPROVED EG&G DATE
APPROVED DOE DATE

FILE: F2434-5B.DRW

Status: 04/20/94



Bottom-Sediment Plutonium-239/240 Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 5-10, 1992

DRAWN TS 5/11/94	DATE
CHECKED 5/11/94	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

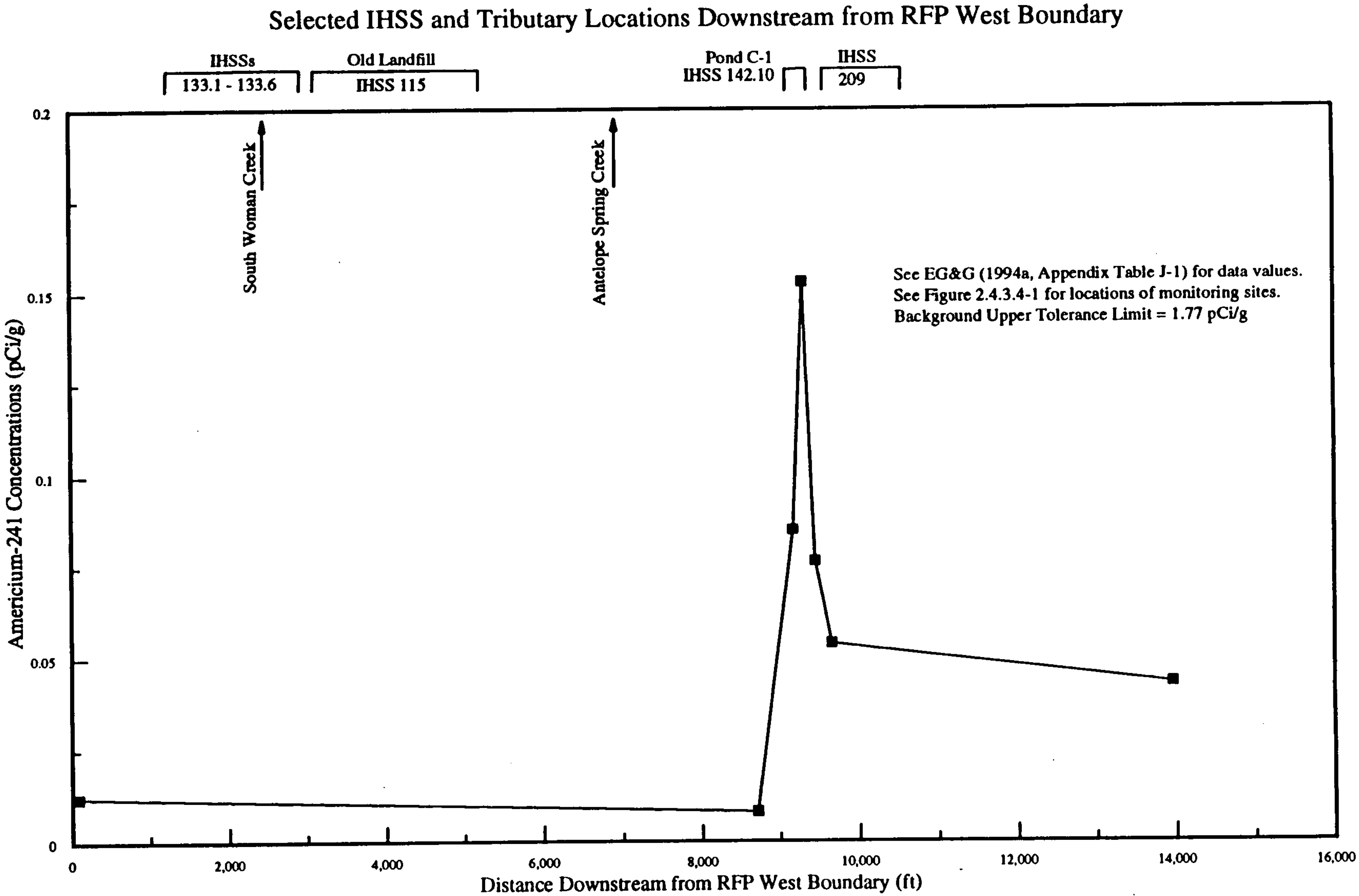
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-5C

FILE: F2434-5C.DRW

Status: 04/20/94



Bottom-Sediment Americium-241 Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 5-10, 1992

DRAWN 5/11/94	DATE
CHECKED	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

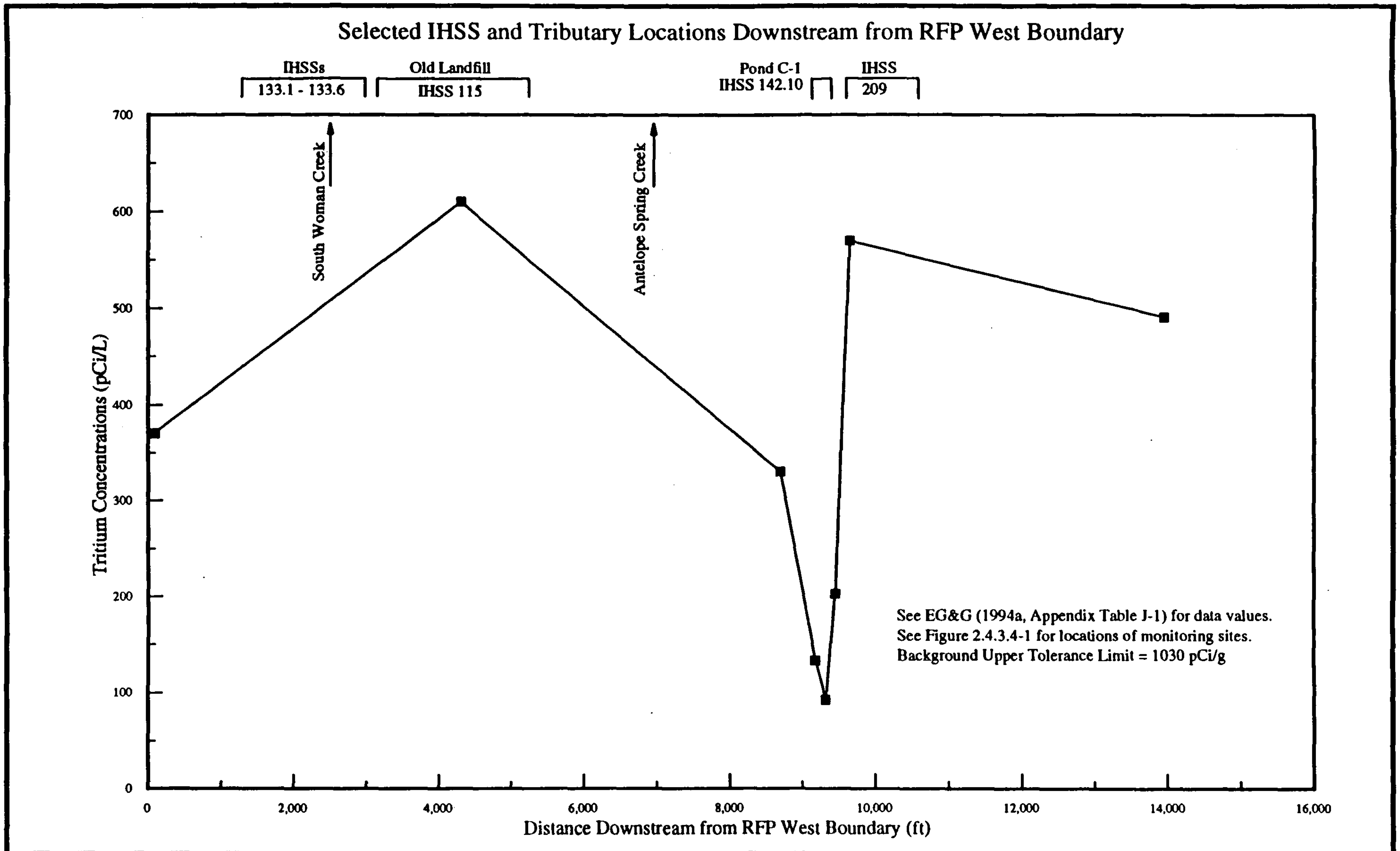
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-5D

FILE: F2434-5D.DRW

Status: 04/20/94



Bottom-Sediment Tritium Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 5-10, 1992

EG&G

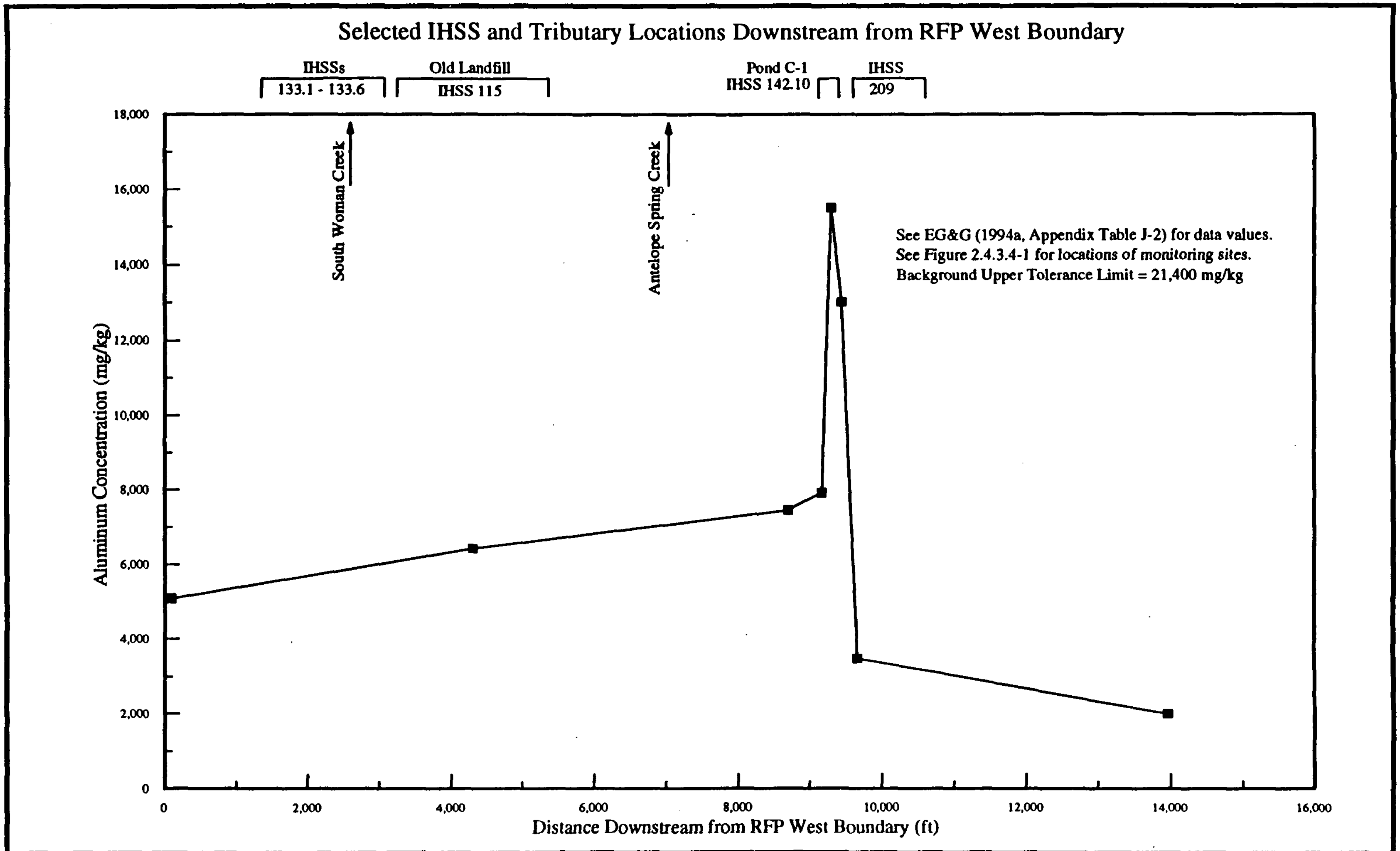
RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-5E

DRAWN TJ 5/11/94 DATE
CHECKED TJ 5/11/94 DATE
APPROVED EG&G DATE
APPROVED DOE DATE

FILE: F2434-5E.DRW

Status: 04/20/94



Bottom-Sediment Aluminum Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 5-10, 1992

EG&G

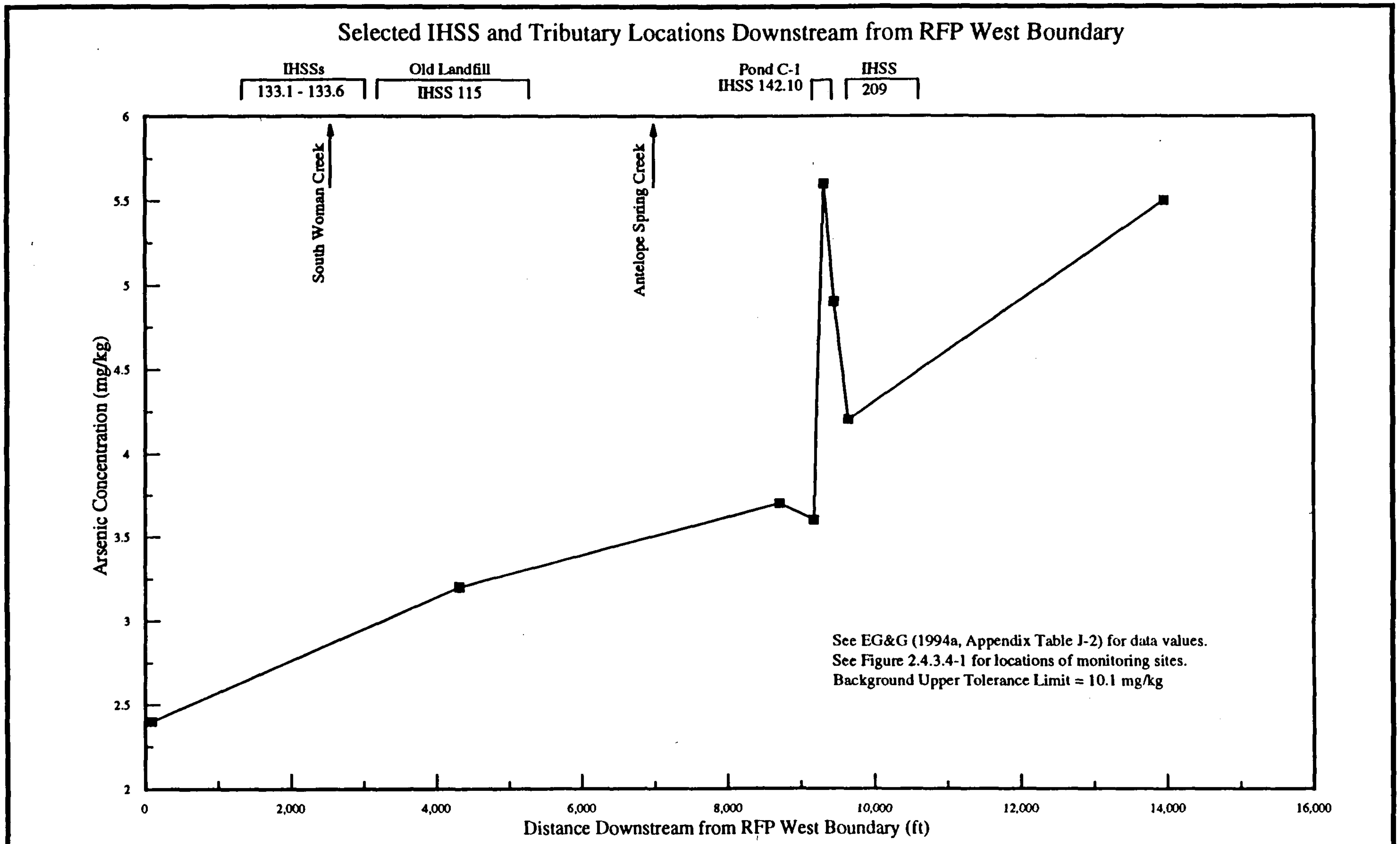
RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-5F

DRAWN TS 5/11/94 DATE
CHECKED [illegible] DATE
APPROVED EG&G DATE
APPROVED DOE DATE

FILE: F2434-5F.DRW

Status: 04/20/94



Bottom-Sediment Arsenic Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 5-10, 1992

DRAWN 78 5/11/94 DATE
CHECKED 7 5/11/94 DATE
APPROVED EG&G ______ DATE
APPROVED DOE ______ DATE

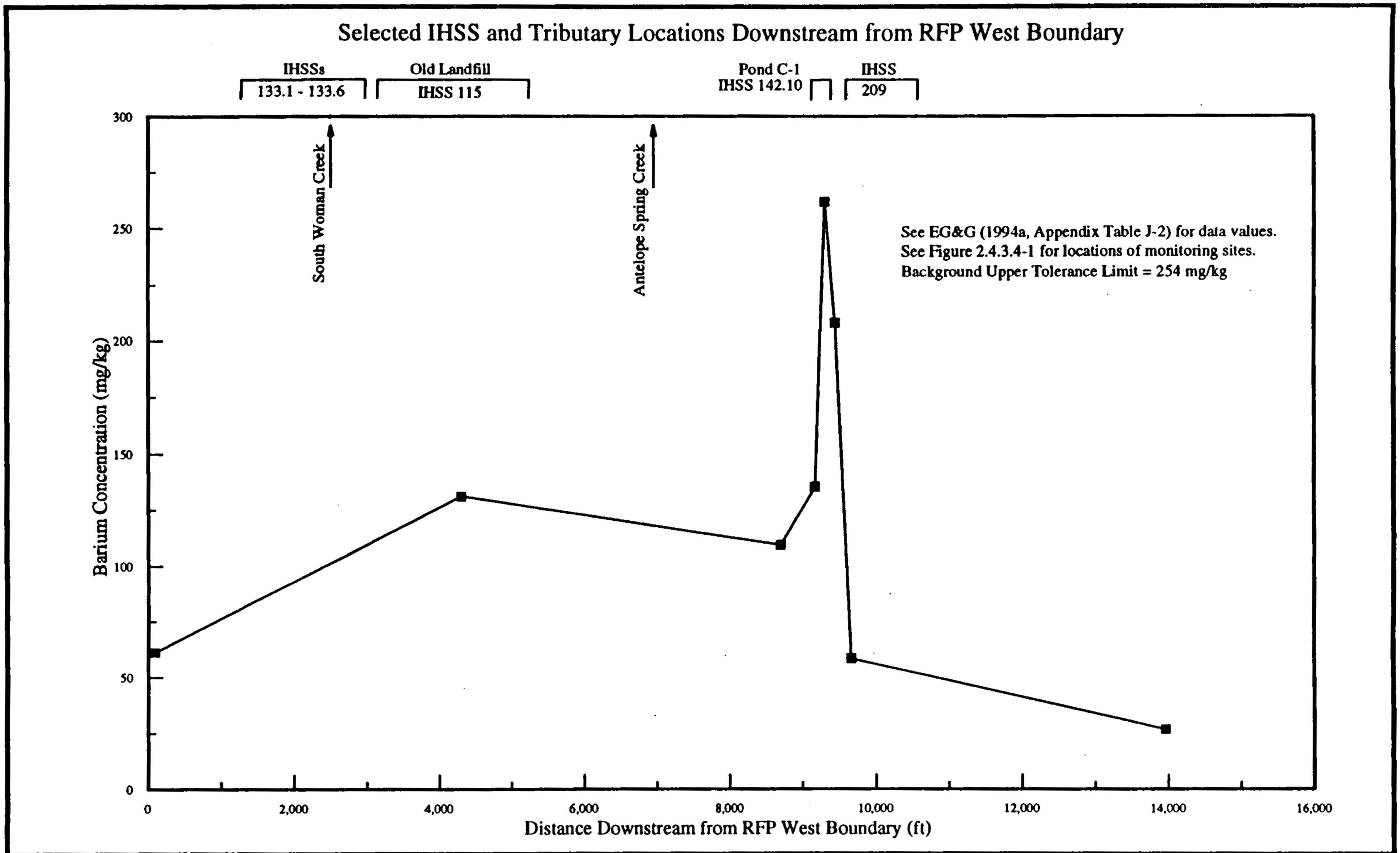
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-5G

FILE: F2434-5G.DRW

Status: 04/20/94



Bottom-Sediment Barium Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 5-10, 1992

DRAWN TB 5/11/94	DATE
CHECKED [illegible] 5/11/94	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

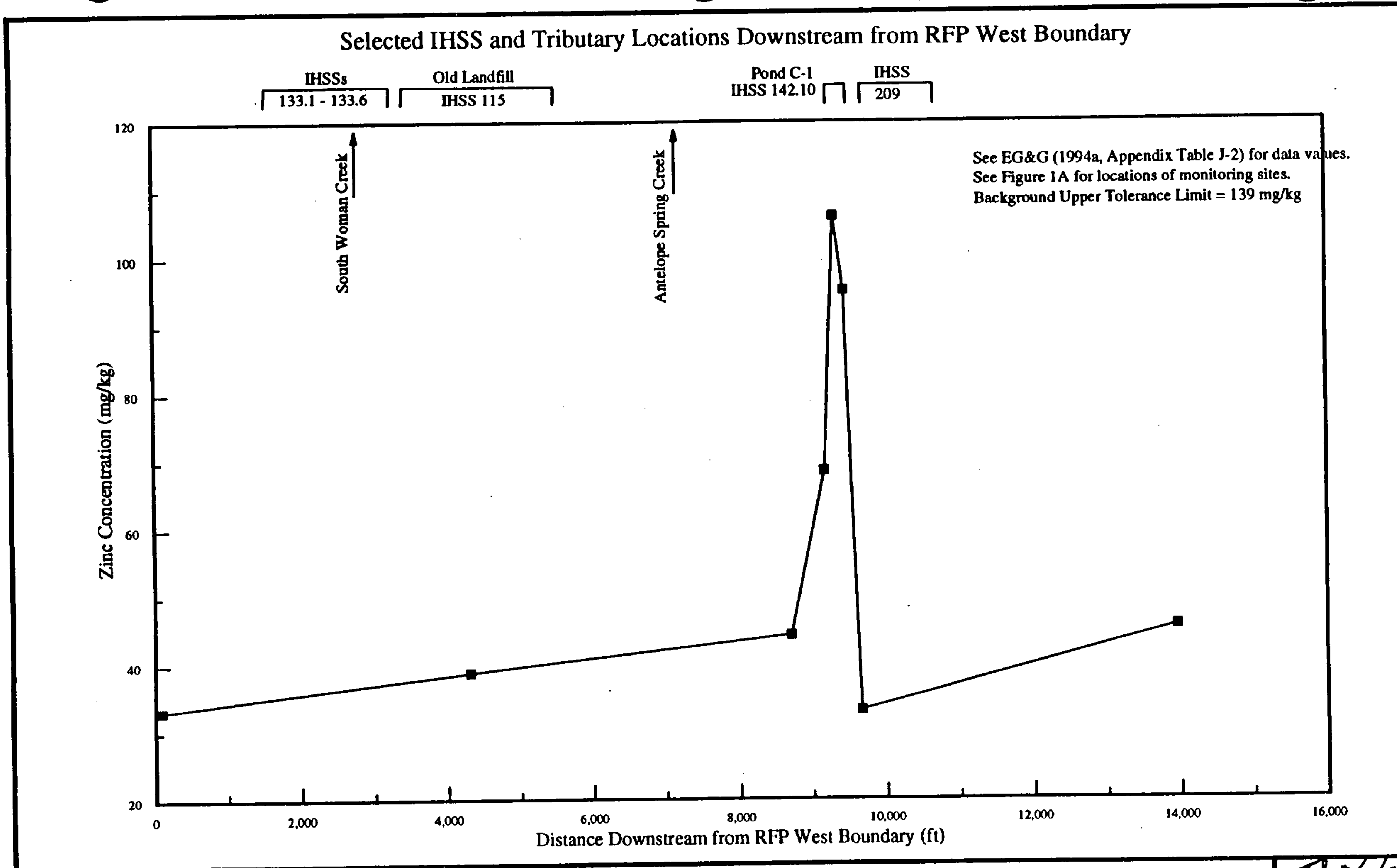
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-5H

FILE: F2434-5H.DRW

Status: 04/20/94



Bottom-Sediment Zinc Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 5-10, 1992

DRAWN TL 5/11/94 DATE
CHECKED 5/11/94 DATE
APPROVED EG&G DATE
APPROVED DOE DATE

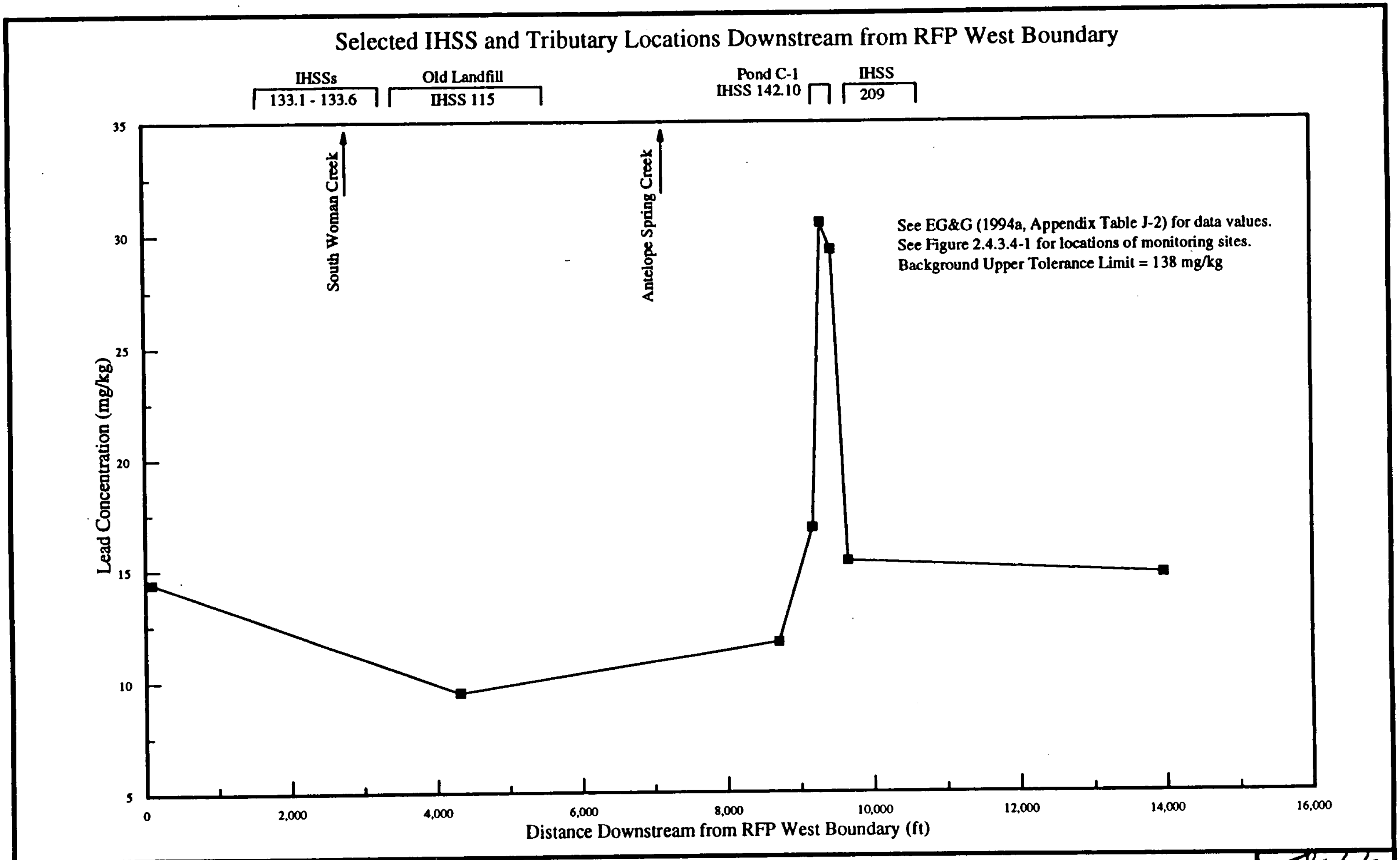
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-5I

FILE: F2434-5I.DRW

Status: 04/20/94



Bottom-Sediment Lead Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 5-10, 1992

DRAWN TD 5/11/94	DATE
CHECKED	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

EG&G

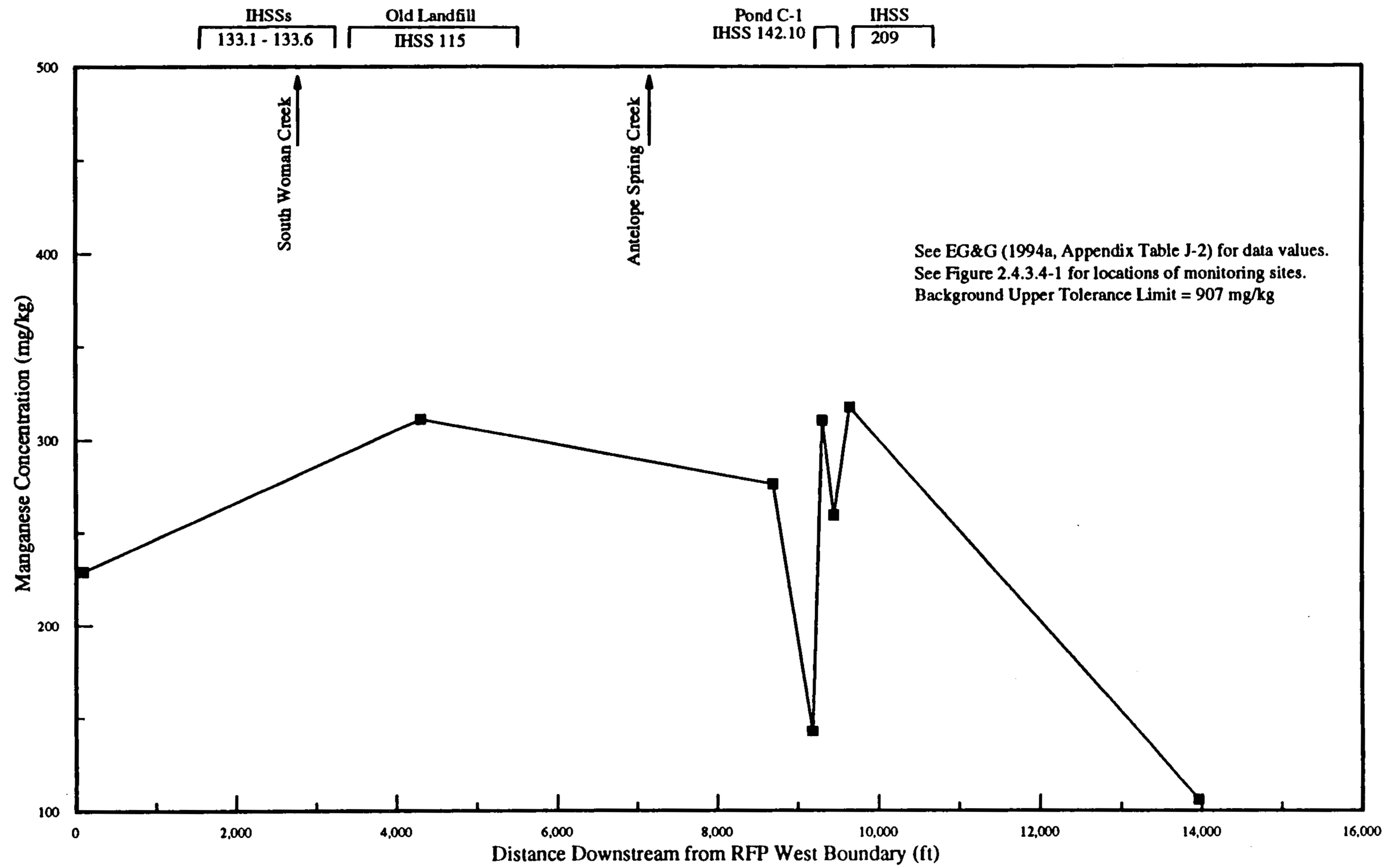
RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-5J

FILE: F2434-5J.DRW

Status: 04/20/94

Selected IHSS and Tributary Locations Downstream from RFP West Boundary



Bottom-Sediment Manganese Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 5-10, 1992

EG&G

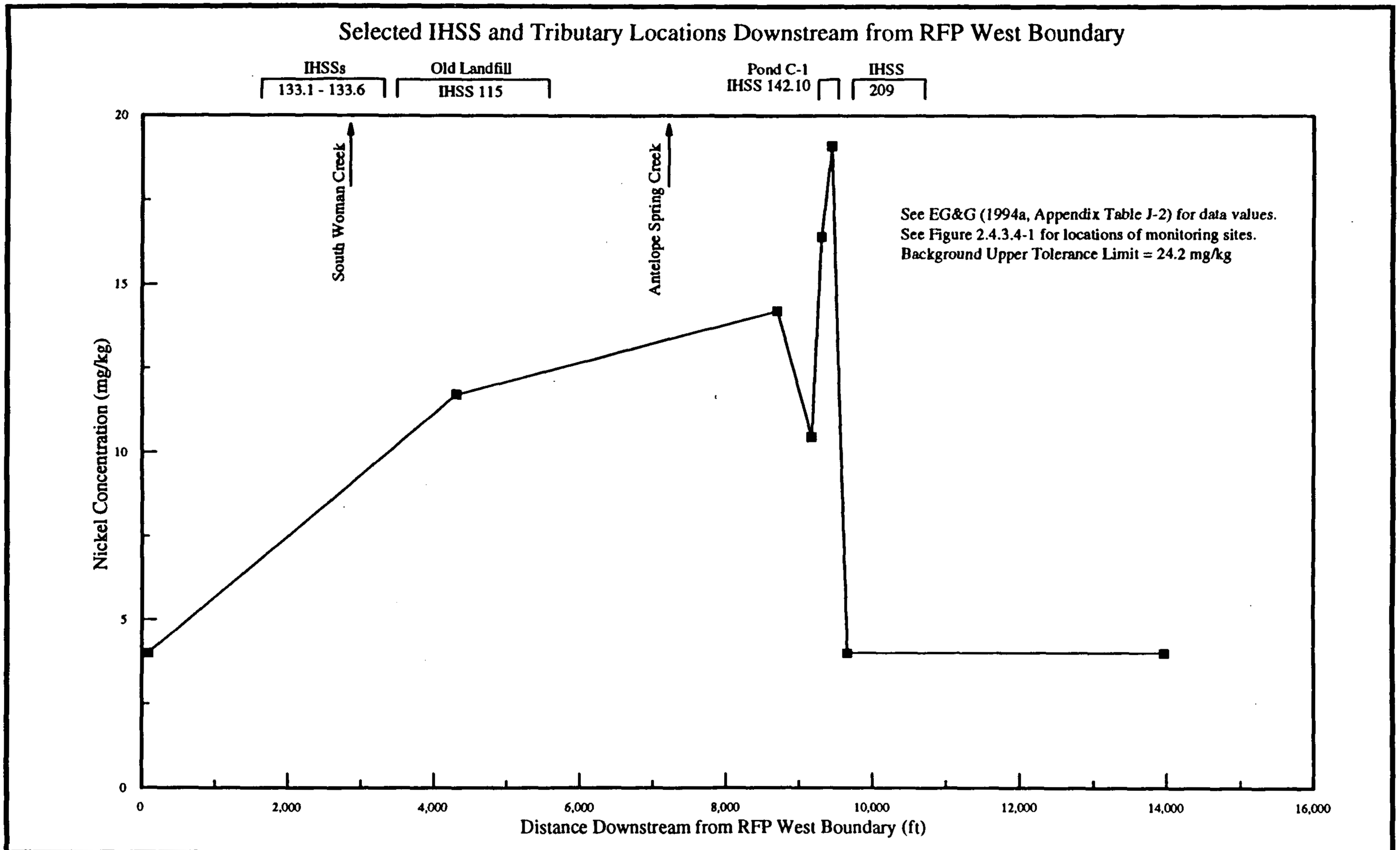
RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-5K

DRAWN TG 5/11/94	DATE
CHECKED JP 5/11/94	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

FILE: F2434-5K.DRW

Status: 04/20/94



Bottom-Sediment Nickel Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 5-10, 1992

EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

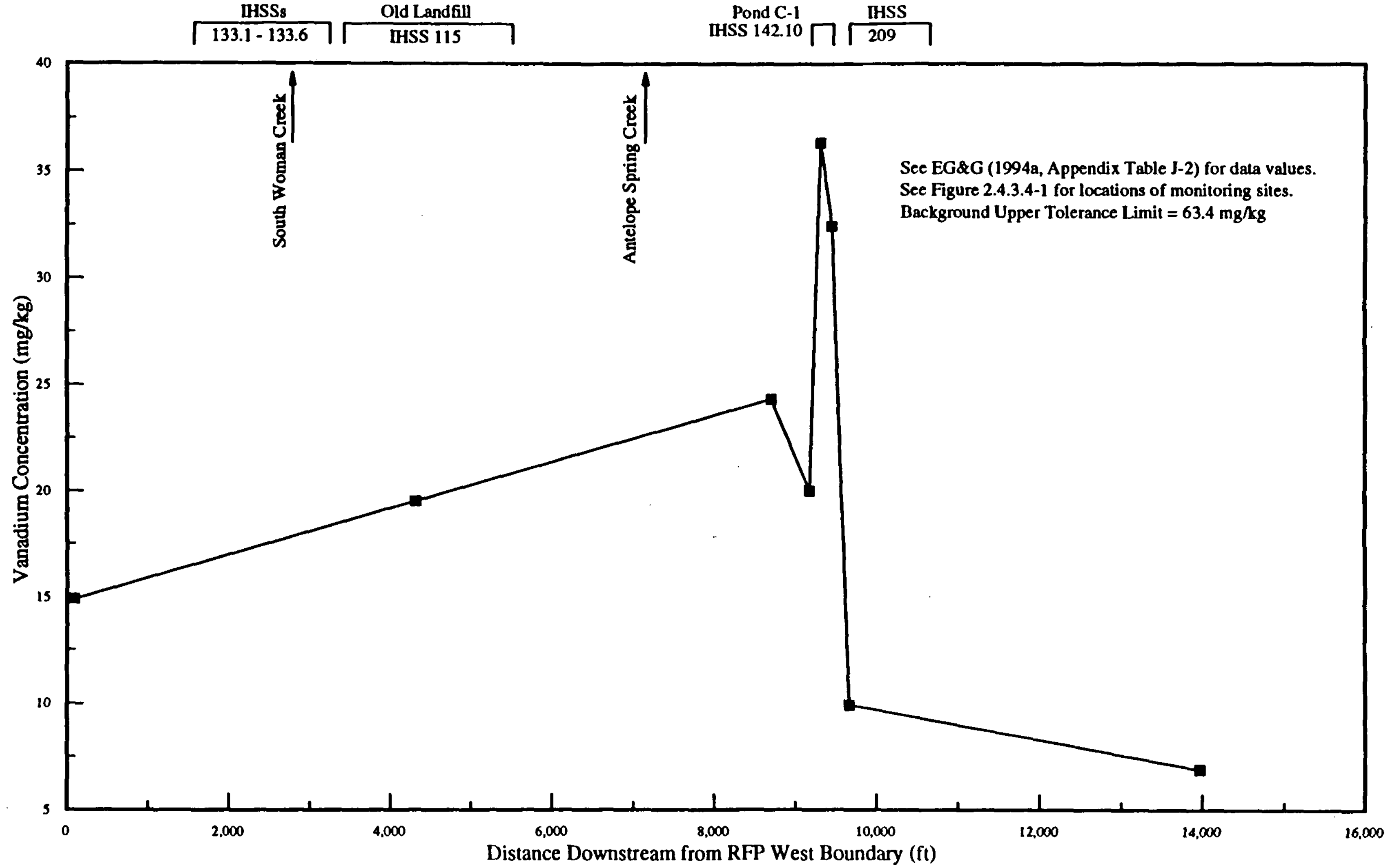
FIGURE 2.4.3.4-5L

DRAWN 5/11/94 DATE
CHECKED 5/11/94 DATE
APPROVED EG&G DATE
APPROVED DOE DATE

FILE: F2434-5L.DRW

Status: 04/20/94

Selected IHSS and Tributary Locations Downstream from RFP West Boundary



Bottom-Sediment Vanadium Concentrations Versus Distance in Woman Creek
Low-Flow Sampling Survey, November 5-10, 1992

DRAWN	5/11/94 DATE
CHECKED	5/10/94 DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

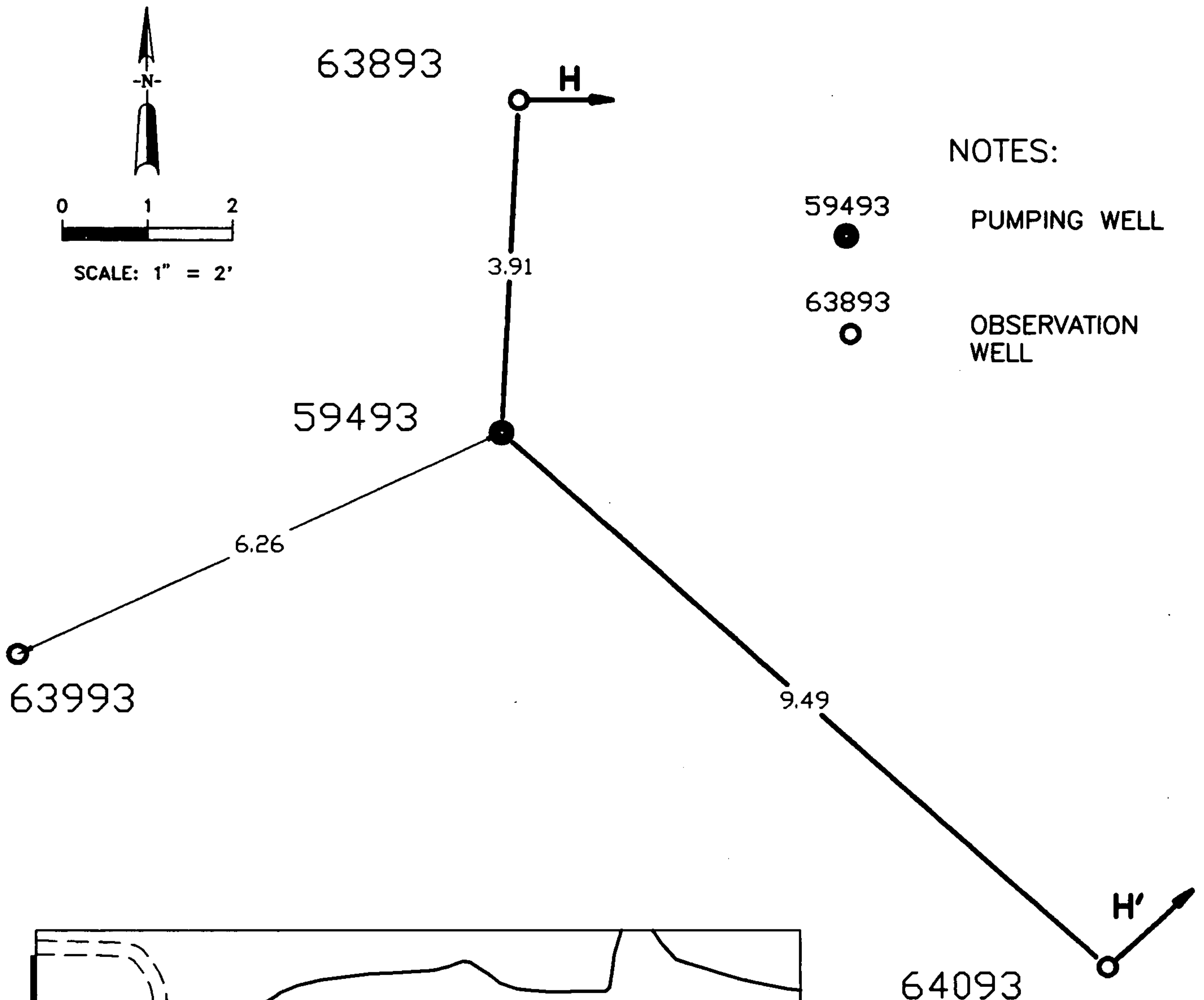
EG&G

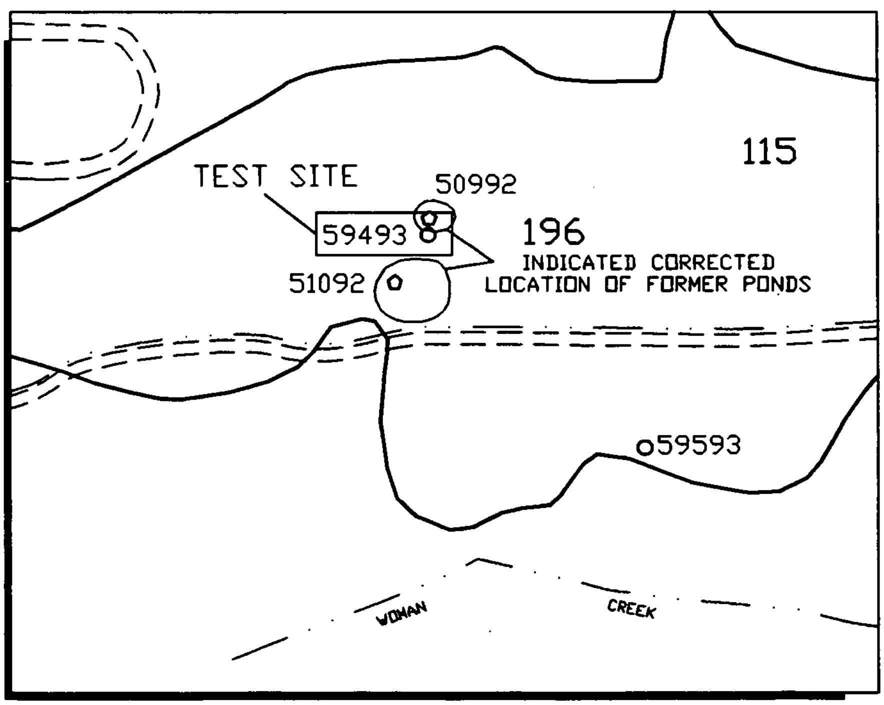
RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.4.3.4-5M

FILE: F2434-5M.DRW

Status: 04/20/94





Drawn N.M.	5/11/94 Date
Checked [illegible]	5/11/94 Date
Approved EG&G	Date
Approved DOE	Date

AQUIFER PUMPING TEST SITE MAP IHSS 115

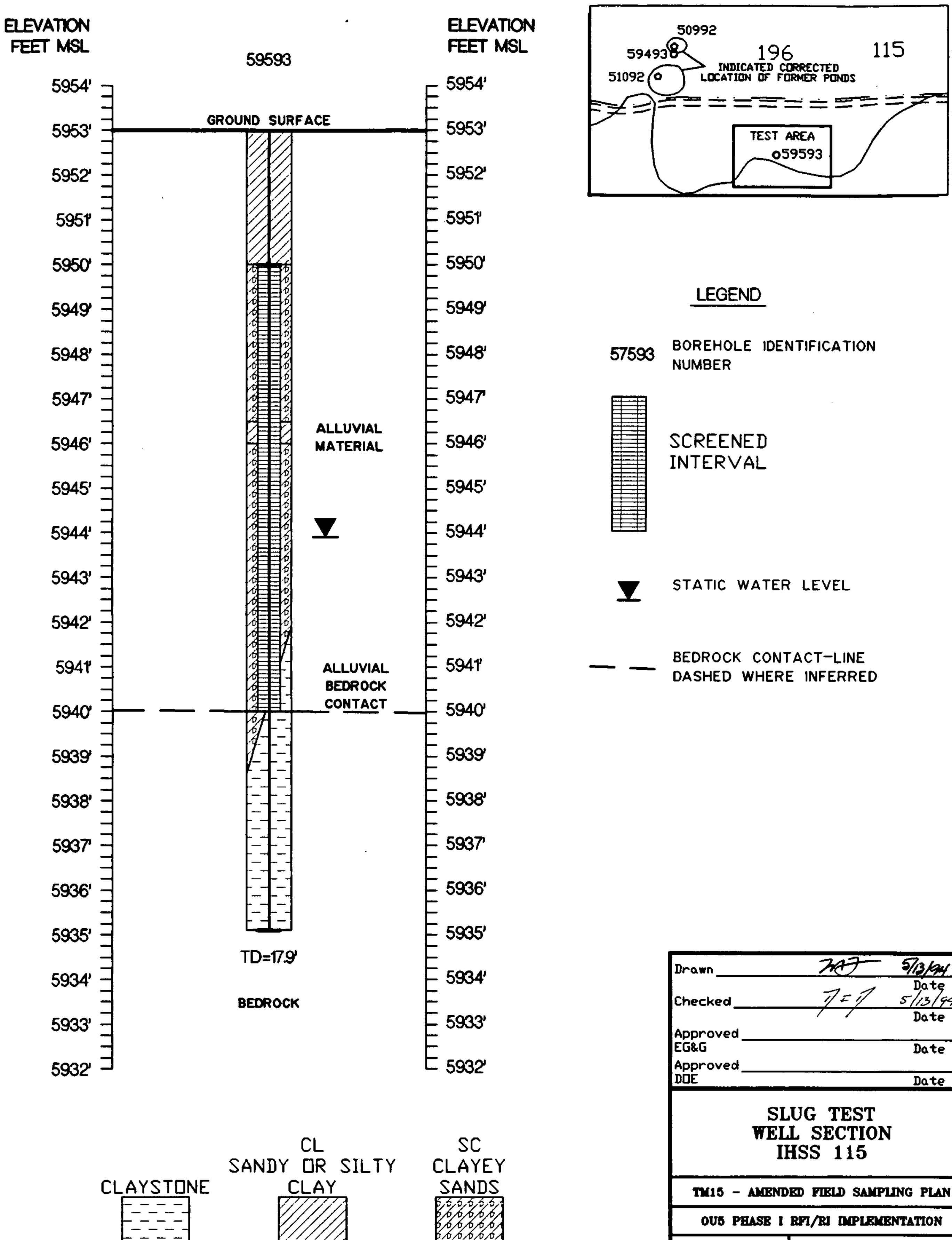
TM15 – AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.4.4.3-5

2443-5.DWG



Drawn		5/13/94 Date
Checked		5/13/94 Date
Approved EG&G		Date
Approved DOE		Date

SLUG TEST WELL SECTION IHSS 115

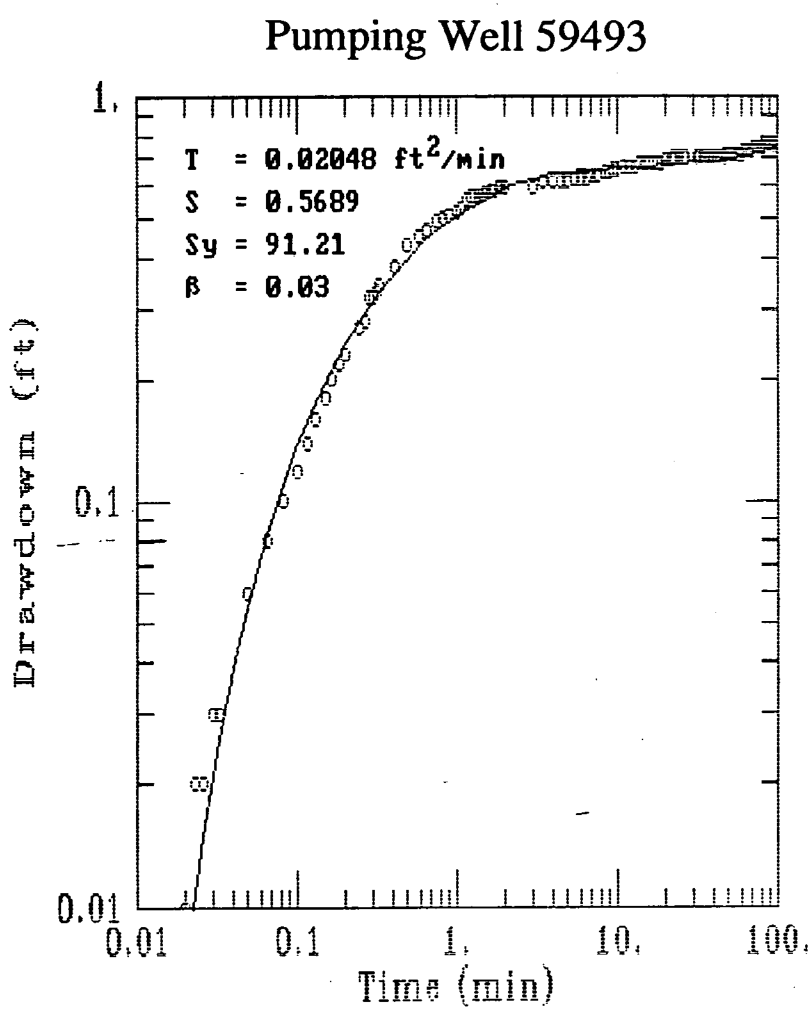
TM15 - AMENDED FIELD SAMPLING PLAN

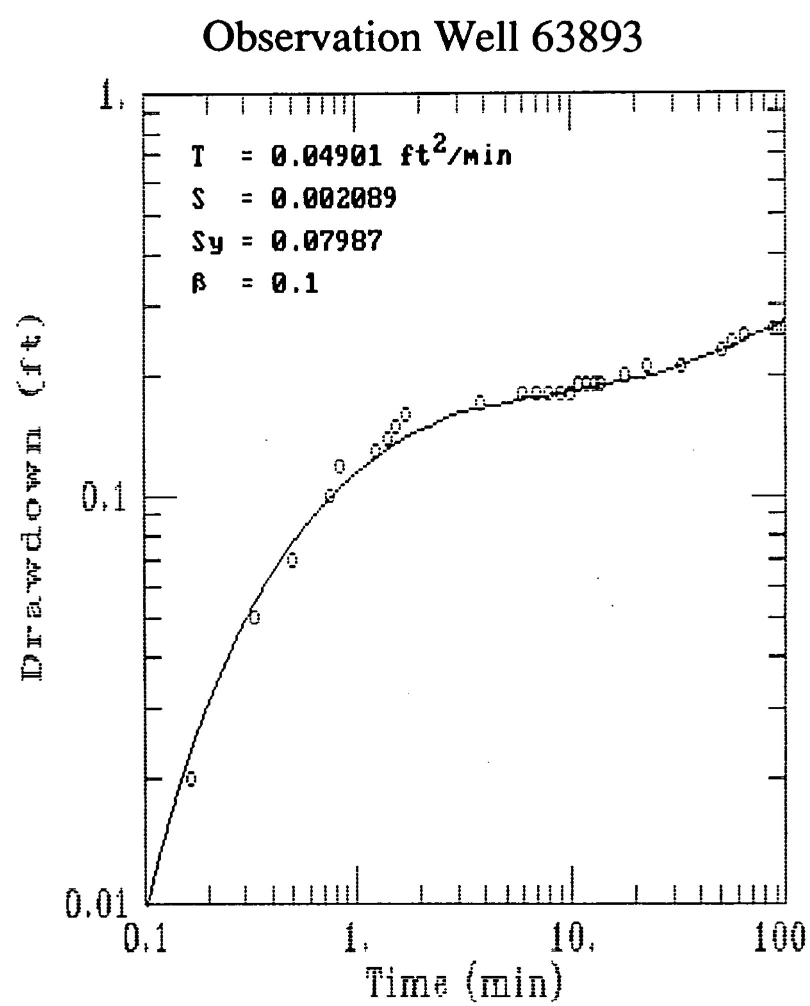
OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.4.4.3-7

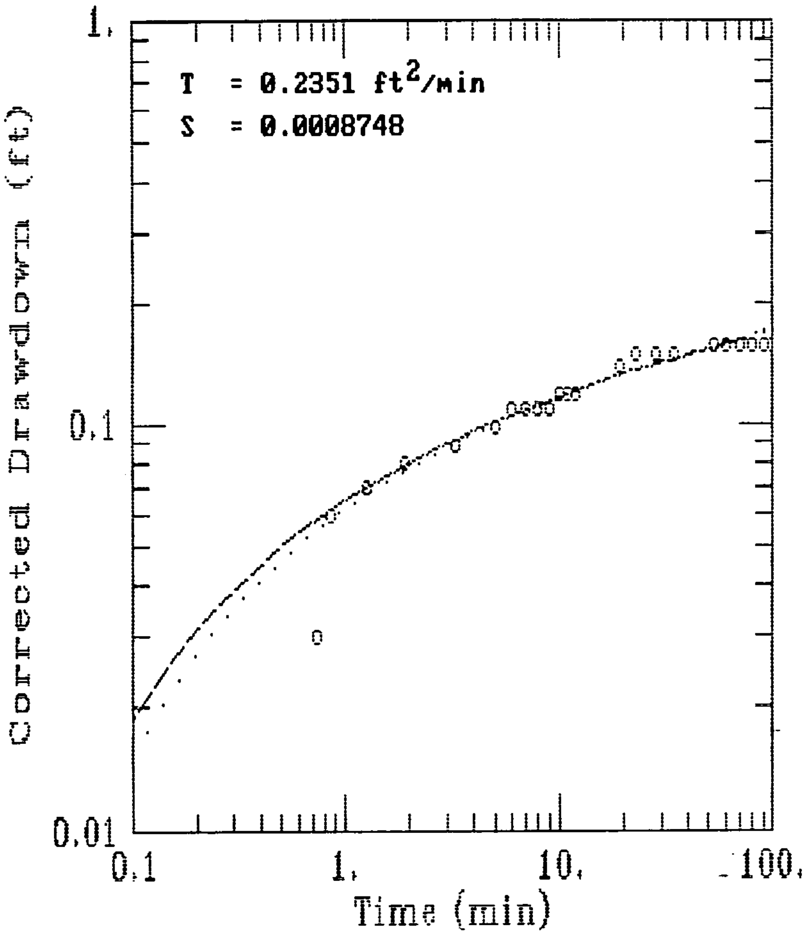
2443-7.DWG



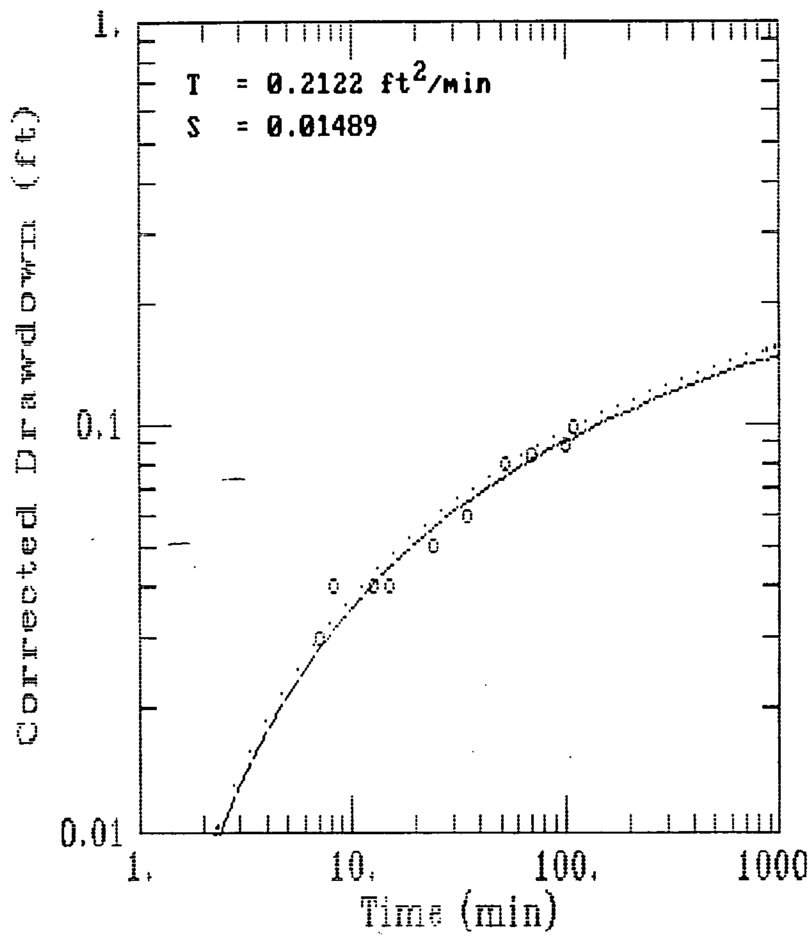


DRAWN ____ DATE	IHSS 115 AQUIFER TEST DATA ANALYSIS TEST DATE: AUGUST 25, 1993 PW59493 AND OW63893
CHECKED ____ DATE	TM15 - AMENDED FIELD SAMPLING PLAN
APPROVED EG&G ____ DATE	OU5 PHASE I RFI/RI IMPLEMENTATION
APPROVED DOE ____ DATE	EG&G — MAY 1994 — FIGURE 2.4.4.3-9

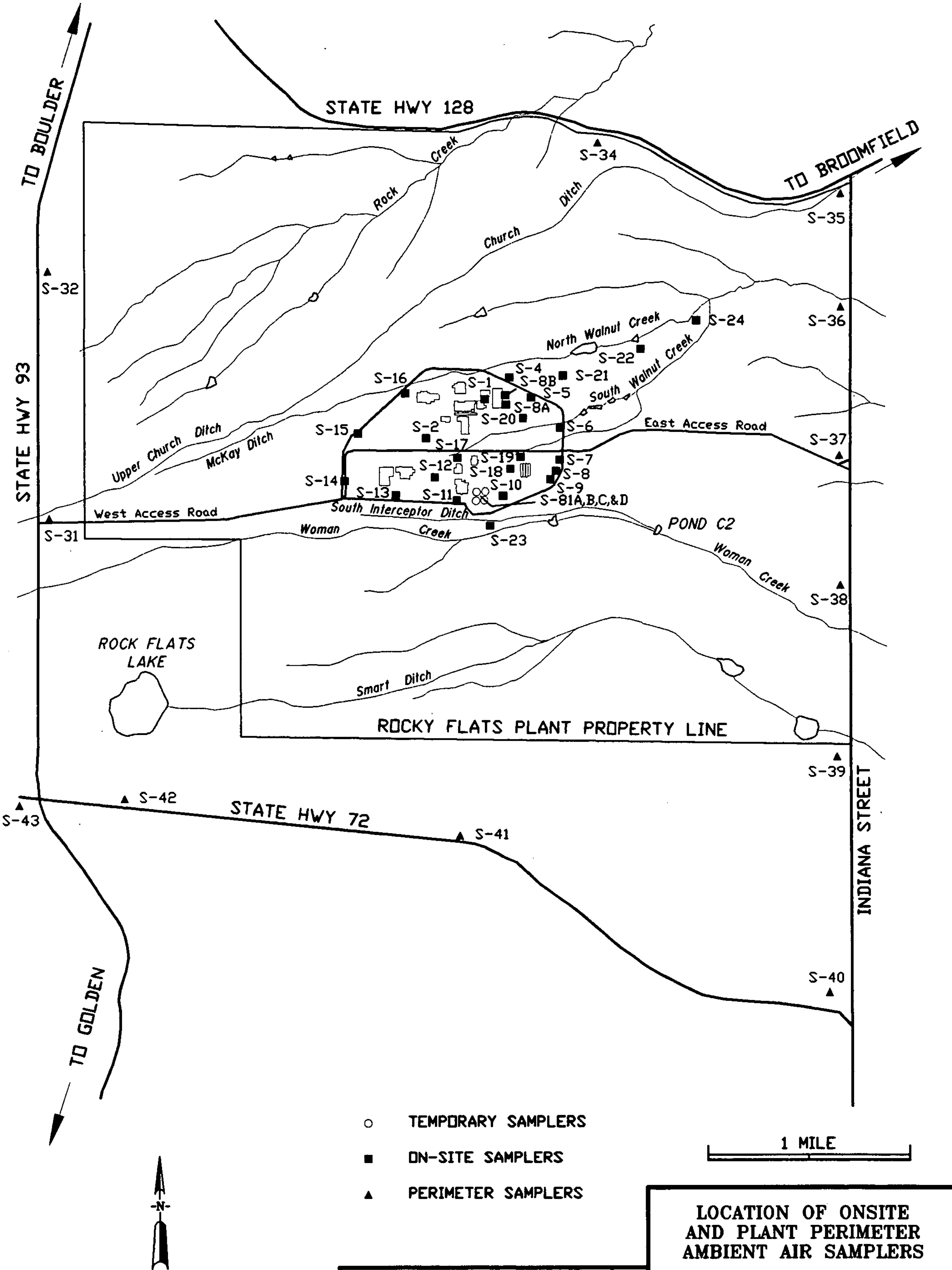
Observation Well 63993



Observation Well 64093



DRAWN ______ DATE	IHSS 115 AQUIFER TEST DATA ANALYSIS TEST DATE: AUGUST 25, 1993 OW63993 AND OW64093
CHECKED ______ DATE	TM15 - AMENDED FIELD SAMPLING PLAN
APPROVED EG&G ______ DATE	OU5 PHASE I RFI/RI IMPLEMENTATION
APPROVED DOE ______ DATE	EG&G · MARCH, 1994 · FIGURE 2.4.4.3-10



(after: U.S.G.S. Quads;
Lousville, 1979; Golden, 1980;
Lafayette, 1979; and Arvada, 1980.)

Drawn N.M.	5/12/94 Date
Checked [signature]	5/12/94 Date
Approved EG&G	Date
Approved DOE	Date

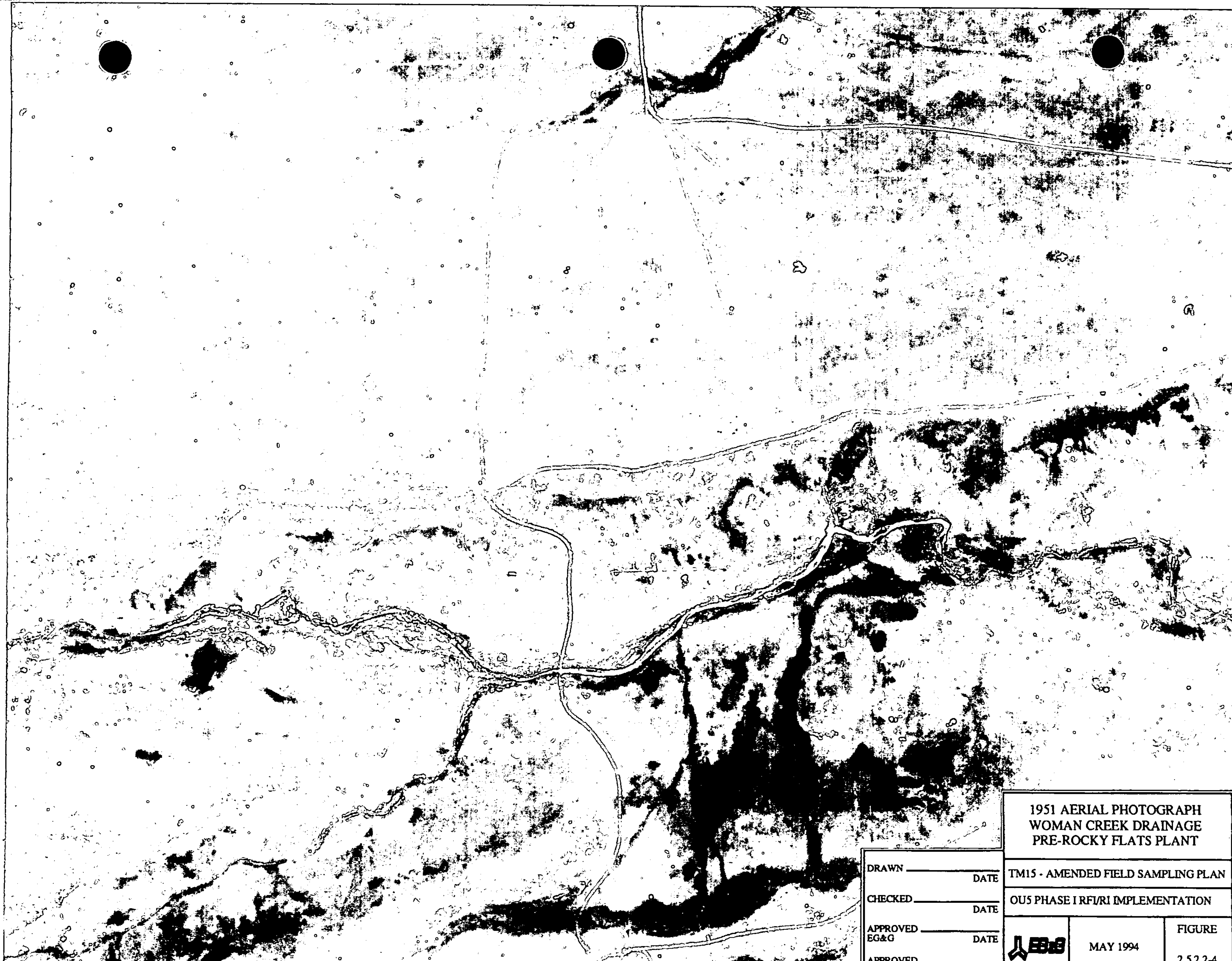
LOCATION OF ONSITE AND PLANT PERIMETER AMBIENT AIR SAMPLERS

TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

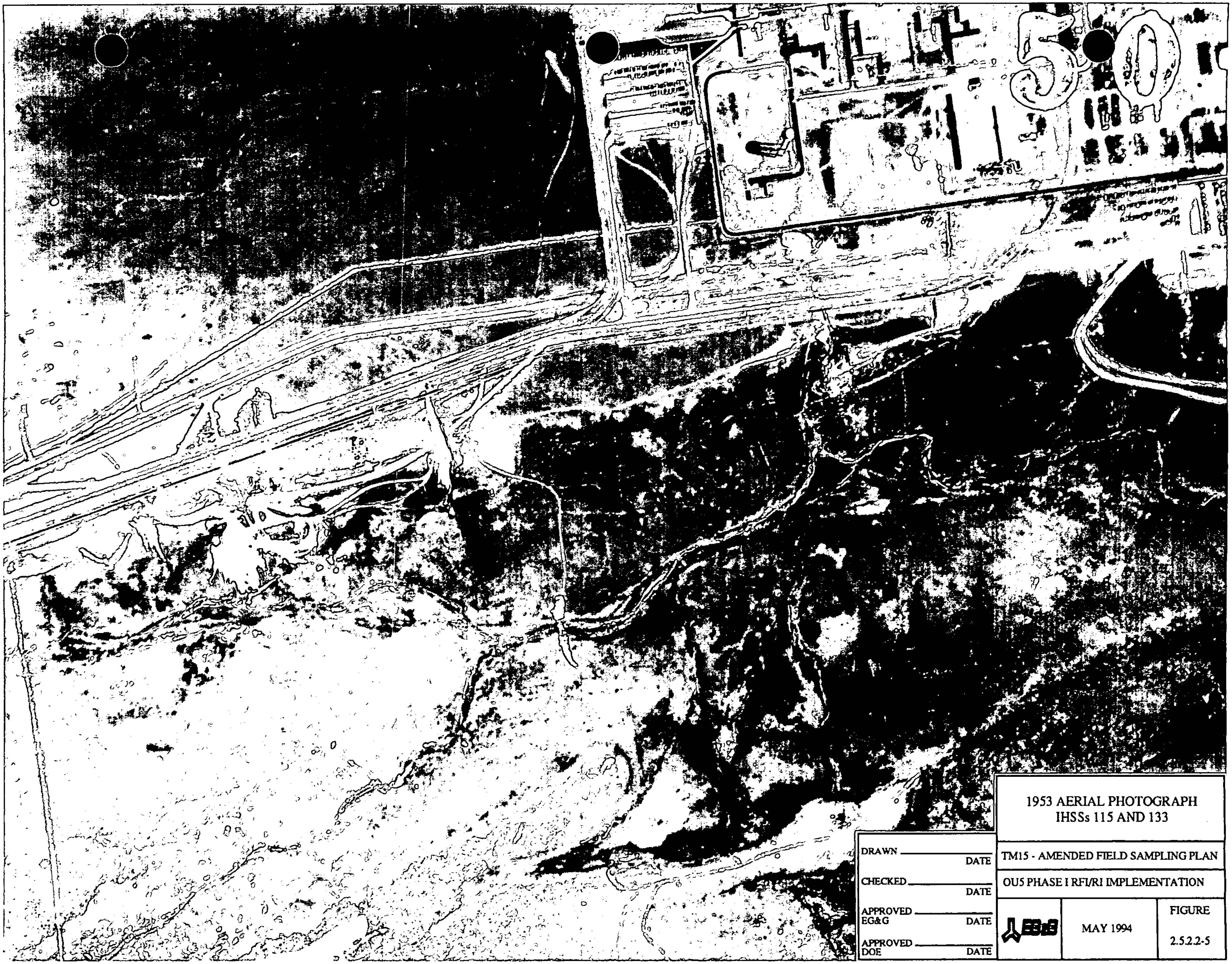
EG&G

FIGURE 2.4.6.1-1

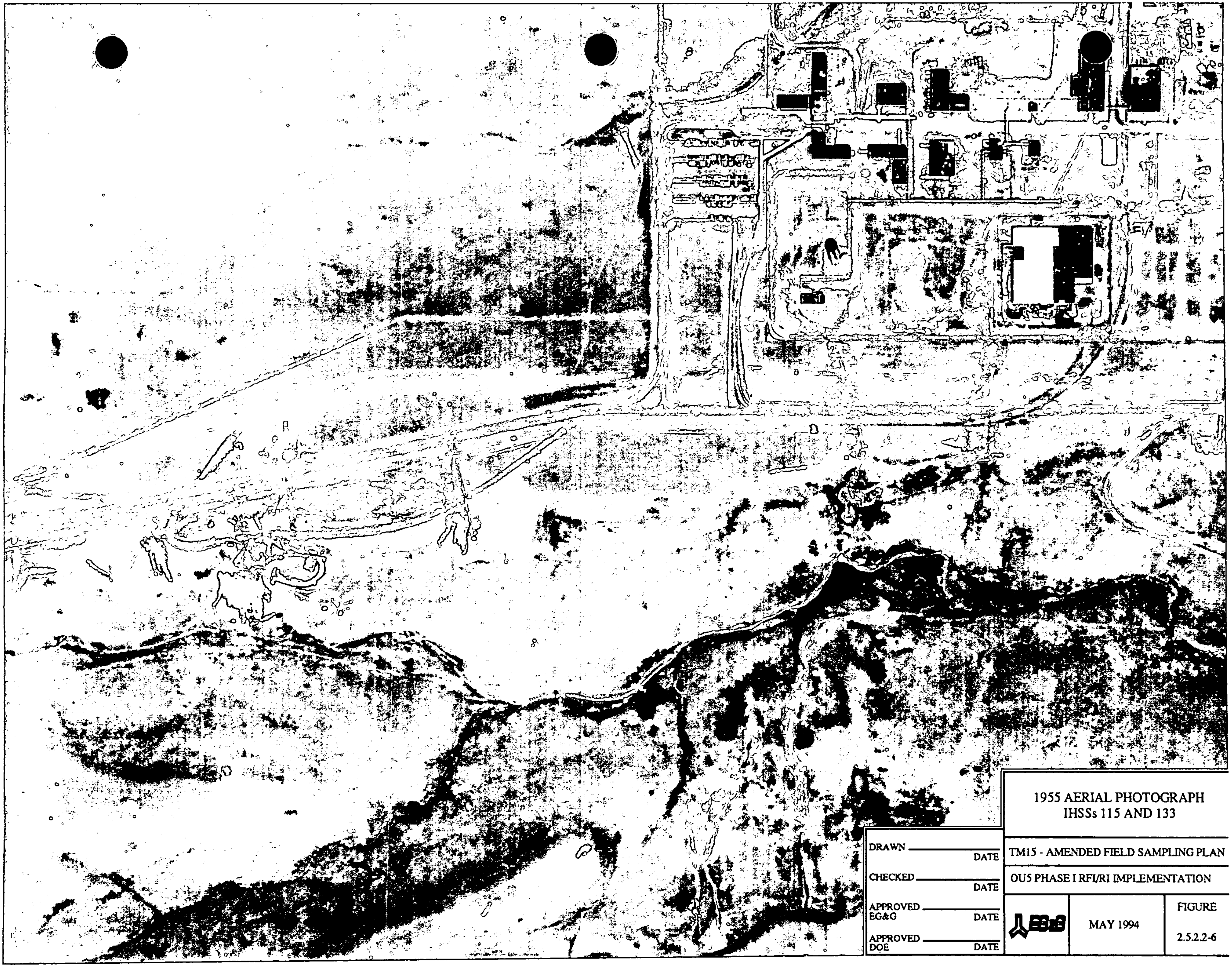


1951 AERIAL PHOTOGRAPH
WOMAN CREEK DRAINAGE
PRE-ROCKY FLATS PLANT

DRAWN ________ DATE	TM15 - AMENDED FIELD SAMPLING PLAN
CHECKED ________ DATE	OU5 PHASE I RFI/RI IMPLEMENTATION
APPROVED EG&G ________ DATE	MAY 1994
APPROVED DOE ________ DATE	FIGURE 2.5.2.2-4

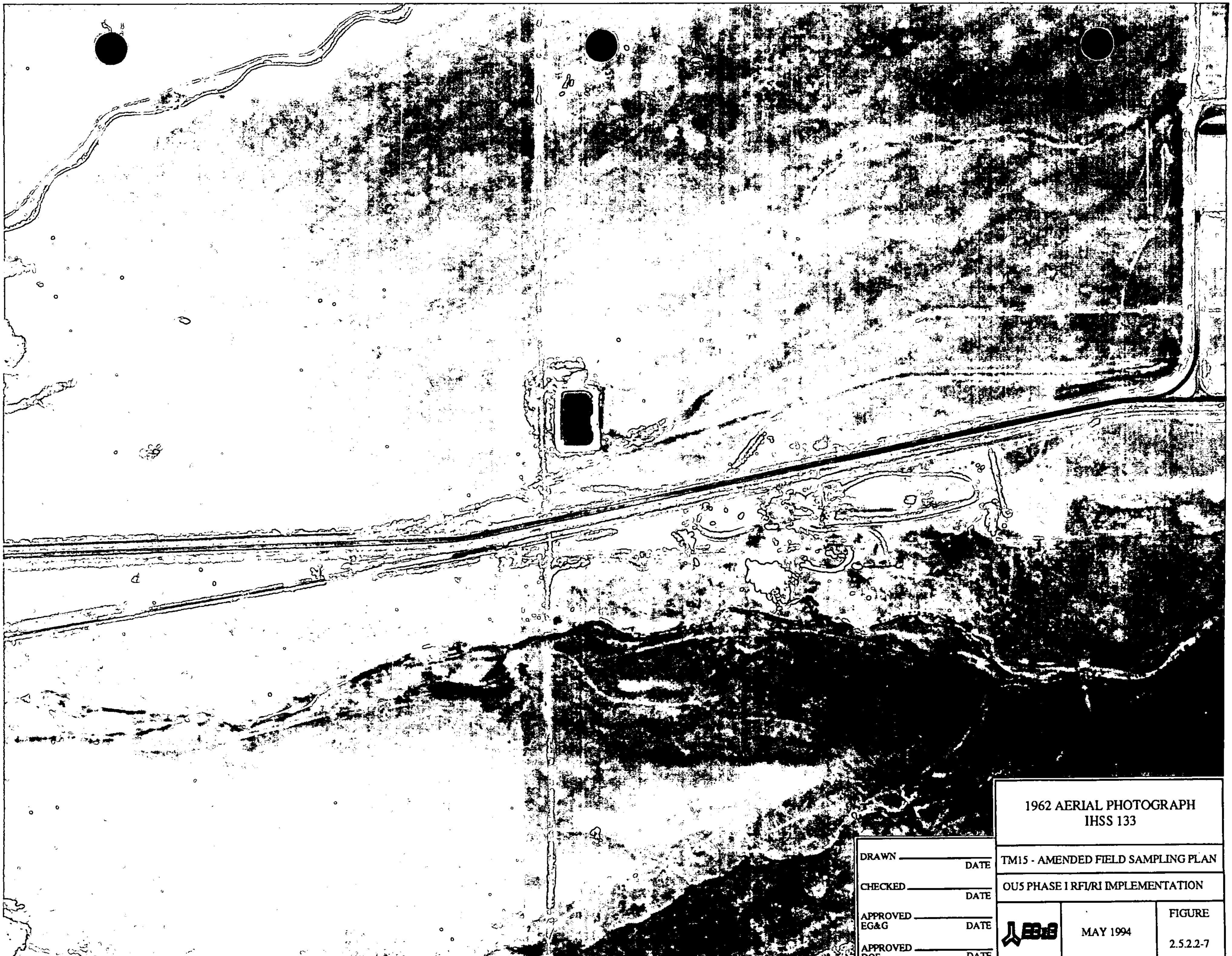


DRAWN ______ DATE	1953 AERIAL PHOTOGRAPH IHSSs 115 AND 133	
CHECKED ______ DATE	TM15 - AMENDED FIELD SAMPLING PLAN	
APPROVED EG&G ______ DATE	OU5 PHASE I RFI/RI IMPLEMENTATION	
APPROVED DOE ______ DATE	EG&G — MAY 1994	FIGURE 2.5.2.2-5

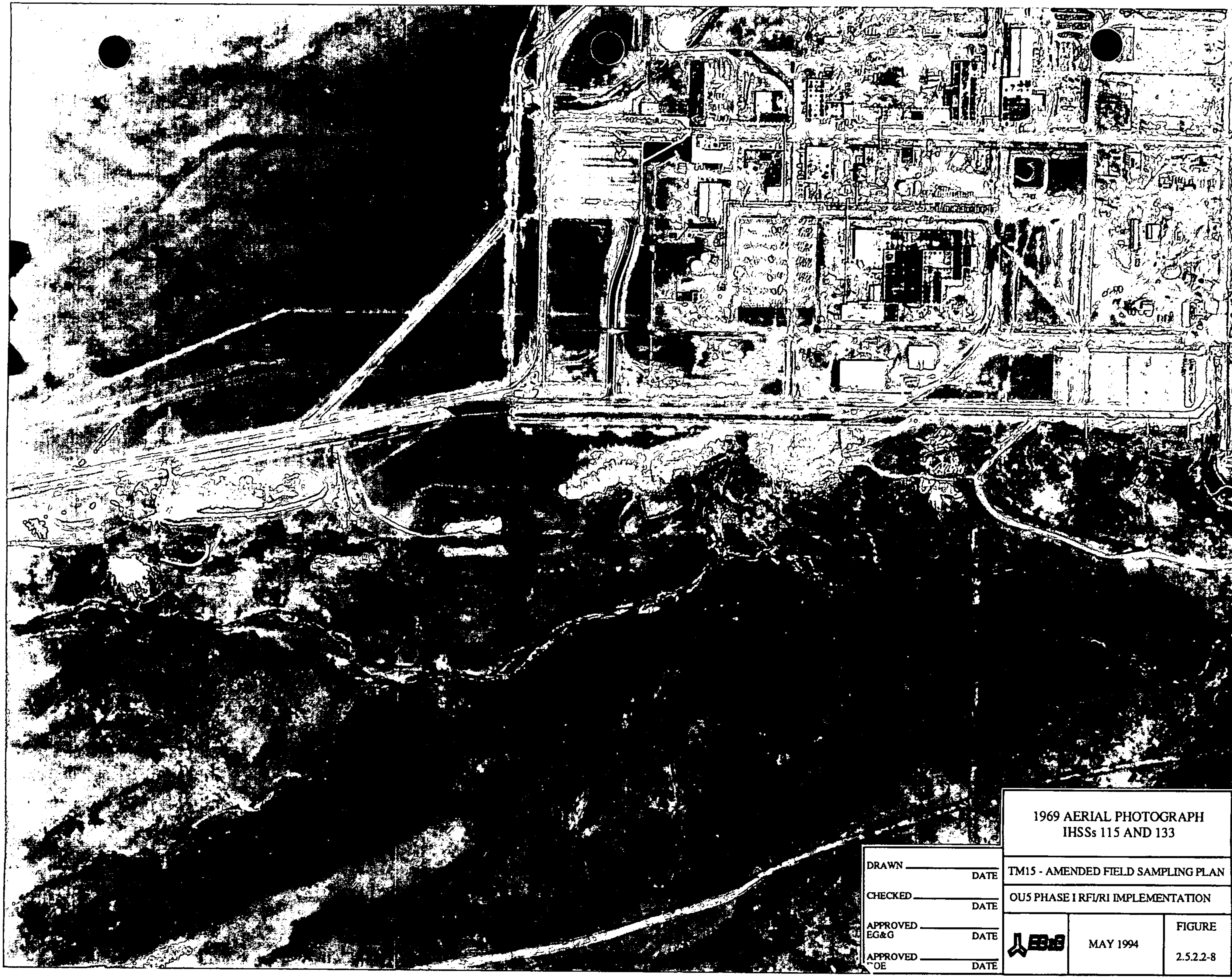


1955 AERIAL PHOTOGRAPH
IHSSs 115 AND 133

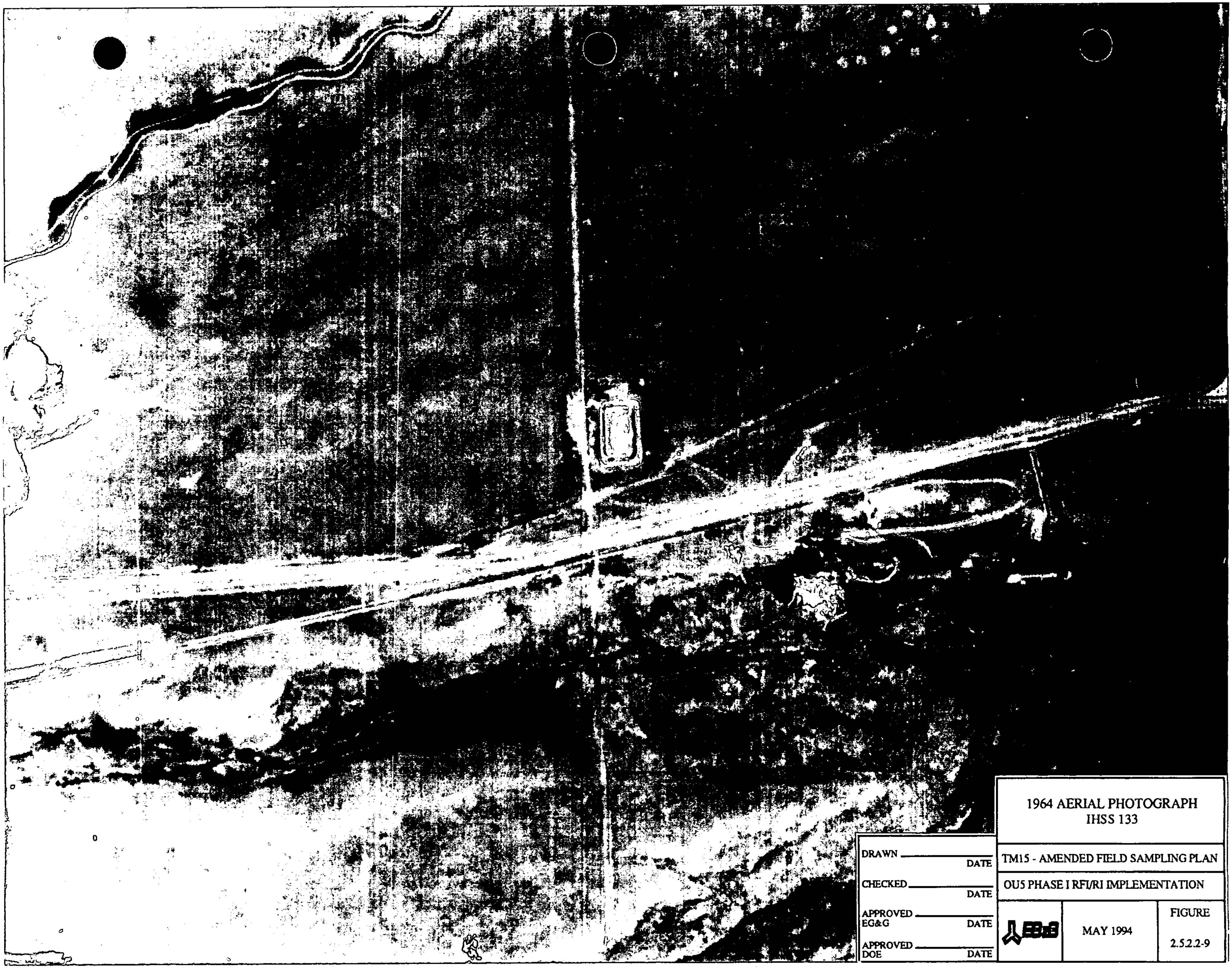
DRAWN ______ DATE	TM15 - AMENDED FIELD SAMPLING PLAN
CHECKED ______ DATE	OU5 PHASE I RFI/RI IMPLEMENTATION
APPROVED EG&G ______ DATE	EG&G — MAY 1994 — FIGURE 2.5.2.2-6
APPROVED DOE ______ DATE	



DRAWN ______ DATE	1962 AERIAL PHOTOGRAPH IHSS 133
CHECKED ______ DATE	TM15 - AMENDED FIELD SAMPLING PLAN
APPROVED EG&G ______ DATE	OU5 PHASE I RFI/RI IMPLEMENTATION
APPROVED DOE ______ DATE	EG&G · MAY 1994 · FIGURE 2.5.2.2-7



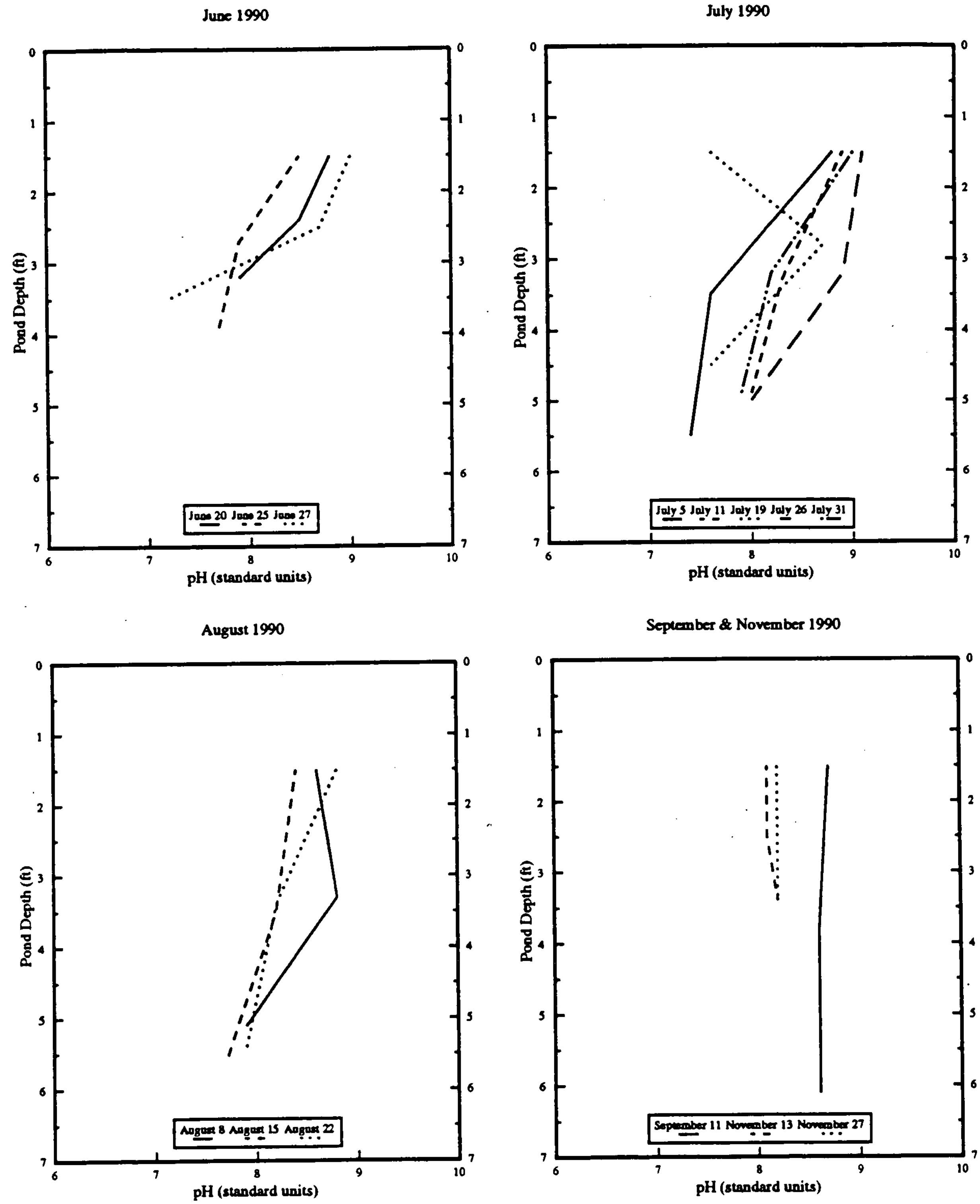
DRAWN ______ DATE	1969 AERIAL PHOTOGRAPH IHSSs 115 AND 133
CHECKED ______ DATE	TM15 - AMENDED FIELD SAMPLING PLAN
APPROVED EG&G ______ DATE	OU5 PHASE I RFI/RI IMPLEMENTATION
APPROVED DOE ______ DATE	EG&G — MAY 1994 — FIGURE 2.5.2.2-8



1964 AERIAL PHOTOGRAPH
IHSS 133

DRAWN ______ DATE	TM15 - AMENDED FIELD SAMPLING PLAN
CHECKED ______ DATE	OU5 PHASE I RFI/RI IMPLEMENTATION
APPROVED EG&G ______ DATE	MAY 1994
APPROVED DOE ______ DATE	FIGURE 2.5.2.2-9

DRAWN ______ DATE	1965 AERIAL PHOTOGRAPH IHSSs 115 AND 133
CHECKED ______ DATE	TM15 - AMENDED FIELD SAMPLING PLAN
APPROVED EG&G ______ DATE	OU5 PHASE I RFI/RI IMPLEMENTATION
APPROVED DOE ______ DATE	EG&G — MAY 1994 — FIGURE 2.5.2.2-10



Source: ASI 1994, Appendix Table B-1

DEPTH-PROFILE DATA, POND C-2
1990 HYDROLAB pH MEASUREMENTS

DRAWN	5/11/94 DATE
CHECKED	5/11/94 DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

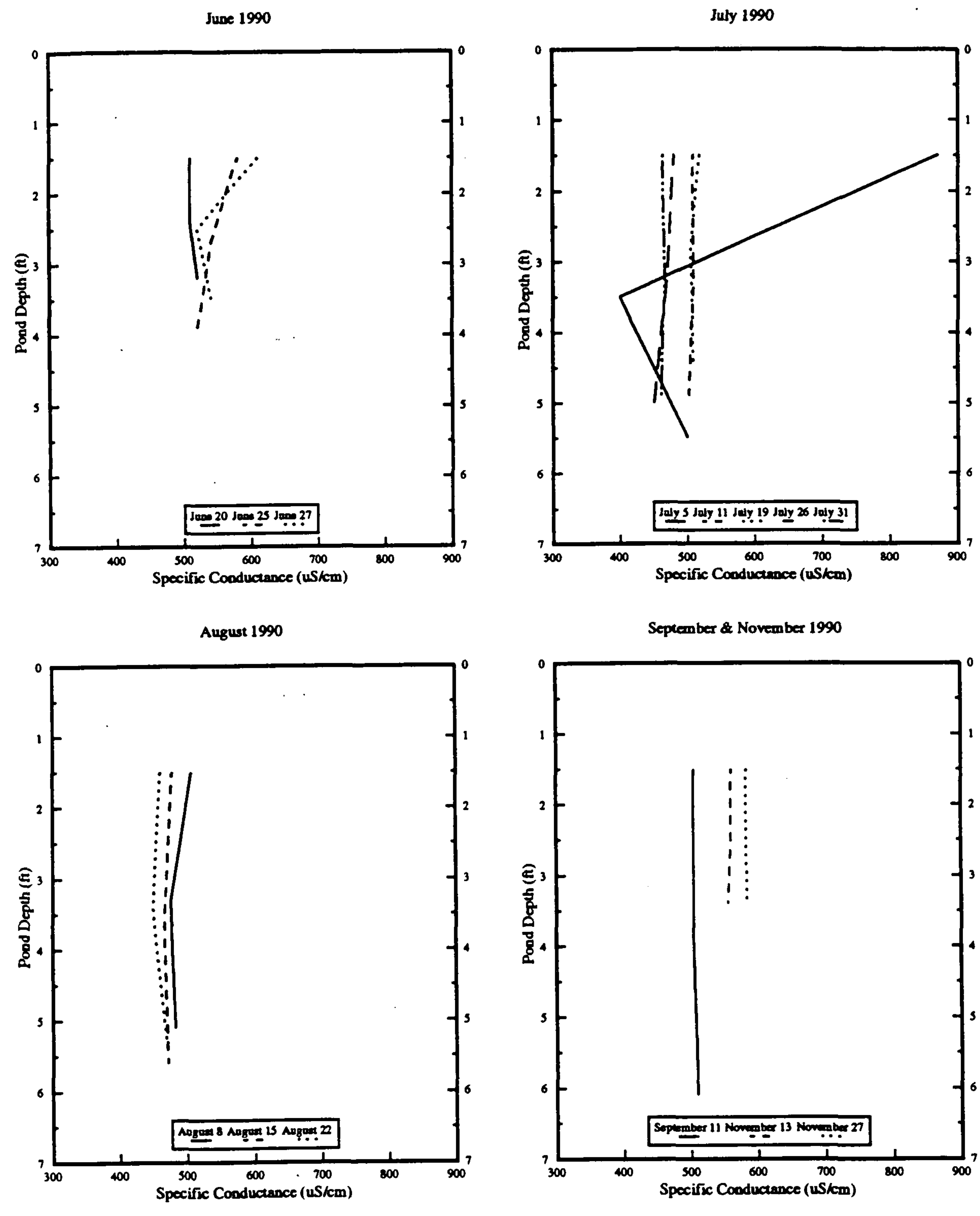
EG&G

RFP, OU5 RFI/RI, TM15
WOMAN CREEK DRAINAGE

FIGURE 2.6.1.2-1A

File: F2612-1A.DRW

Status: 04/20/94



Source: EG&G 1994a, Appendix Table B-1

DEPTH-PROFILE DATA, POND C-2
1990 HYDROLAB SPECIFIC CONDUCTANCE MEASUREMENTS

EG&G

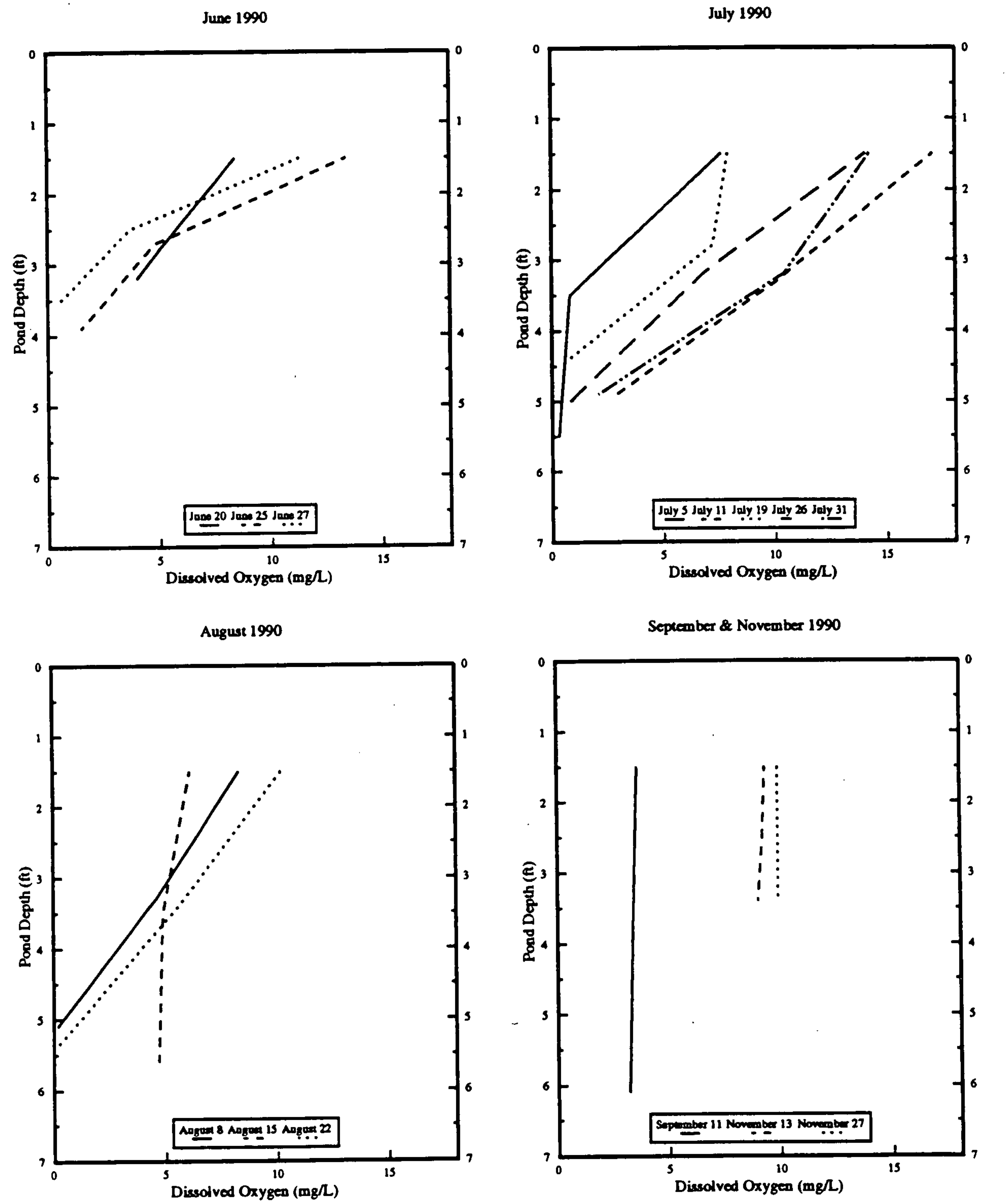
RFP, OU5 RFI/RI, TM15
AMENDED FIELD SAMPLING PLAN

Figure 2.6.1.2-1B

DRAWN TLS 5/11/94	DATE
CHECKED TLS 5/11/94	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

File: F2612-1B.DRW

Status: 4/20/94



Source: EG&G 1994a, Appendix Table B-1

DEPTH-PROFILE DATA, POND C-2
1990 HYDROLAB DISSOLVED OXYGEN MEASUREMENTS

EG&G

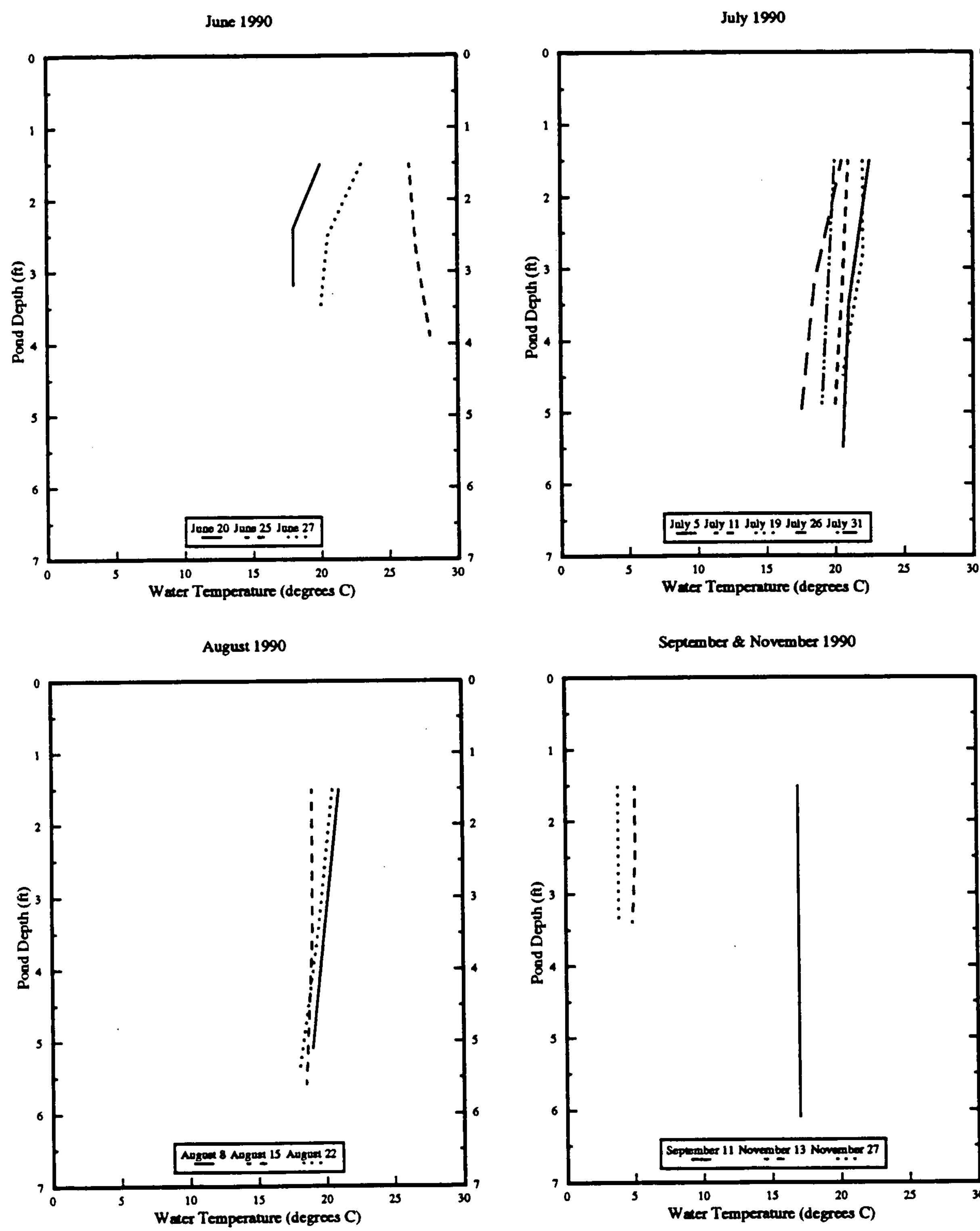
RFP, OU5 RFI/RI, TM15
AMENDED FIELD SAMPLING PLAN

FIGURE 2.6.1.2-1C

DRAWN 5/11/94	DATE
CHECKED 5/11/94	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

File: F2612-1C.DRW

Status: 04/20/94



Source: EG&G 1994a, Appendix Table B-1

DEPTH-PROFILE DATA, POND C-2
1990 HYDROLAB WATER TEMPERATURE MEASUREMENTS

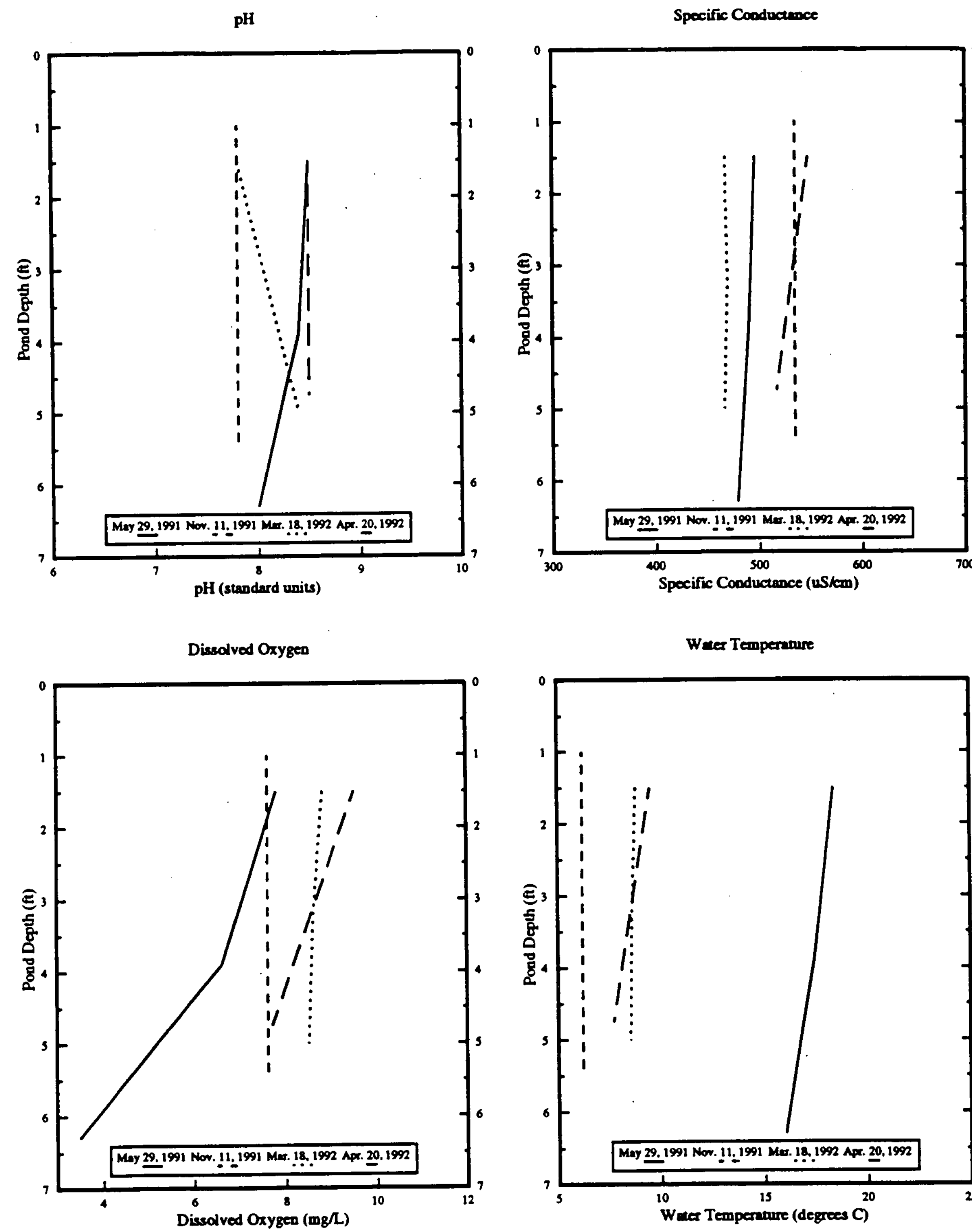
DRAWN 5/11/94 DATE
CHECKED 5/11/94 DATE
APPROVED EG&G DATE
APPROVED DOE DATE

EG&G

RFP, OU5 RFI/RI, TM15
AMENDED FIELD SAMPLING PLAN FIGURE 2.6.1.2-1D

File: F2612-1D.DRW

Status: 04/20/94



Source: EG&G 1994a, Appendix Table B-1

DEPTH-PROFILE DATA, POND C-2
1991 AND 1992 HYDROLAB MEASUREMENTS

DRAWN TS 5/11/94 DATE

CHECKED TQ 5/11/94 DATE

APPROVED EG&G DATE

APPROVED DOE DATE

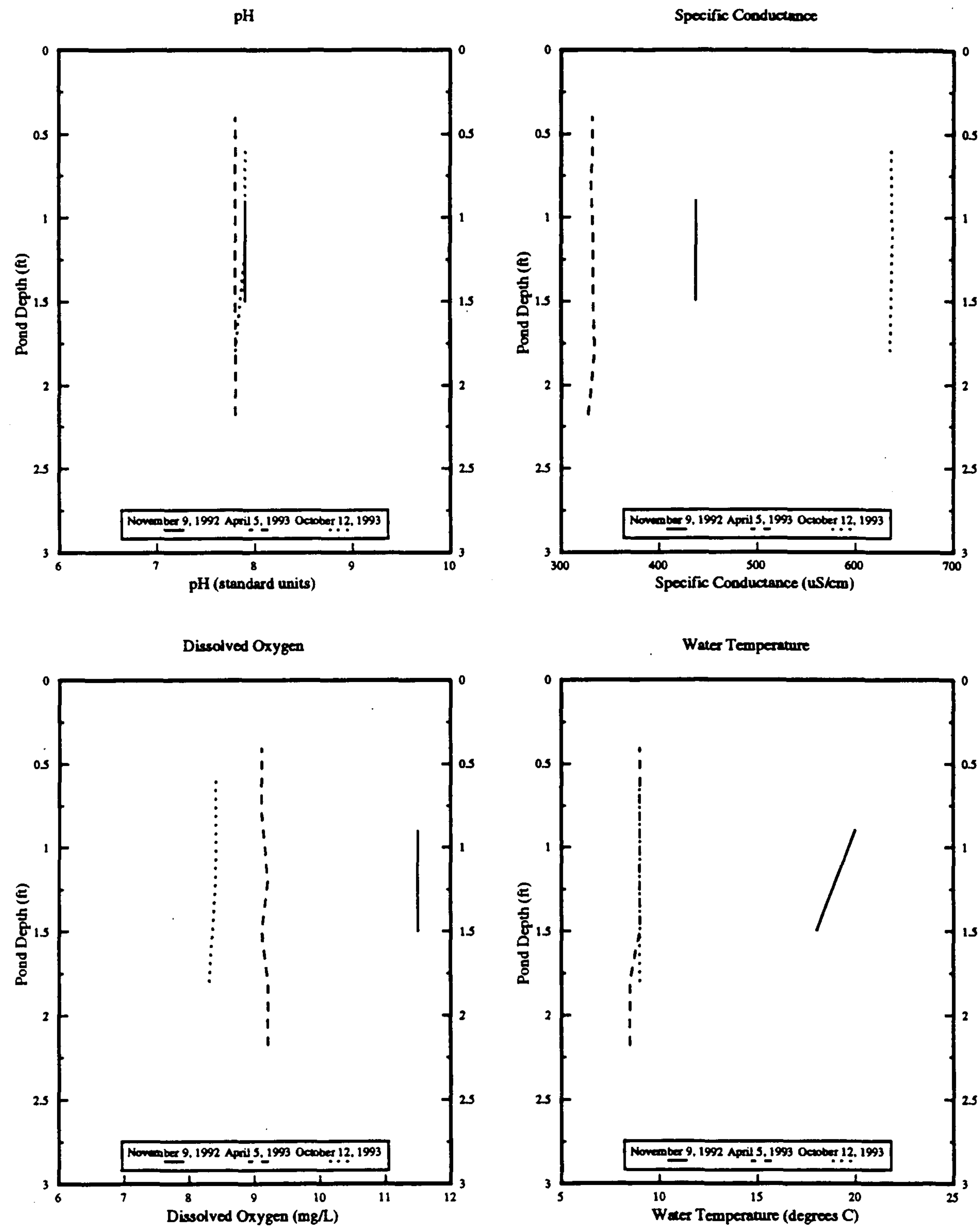
EG&G

RFP, OU5 RFI/RI, TM15
AMENDED FIELD SAMPLING PLAN

FIGURE 2.6.1.2-2

File: F2612-2.DRW

Status: 04/20/94



Source: EG&G 1994a, Appendix Table J-5

DEPTH-PROFILE DATA, POND C-1
1992-1993 HYDROLAB MEASUREMENTS

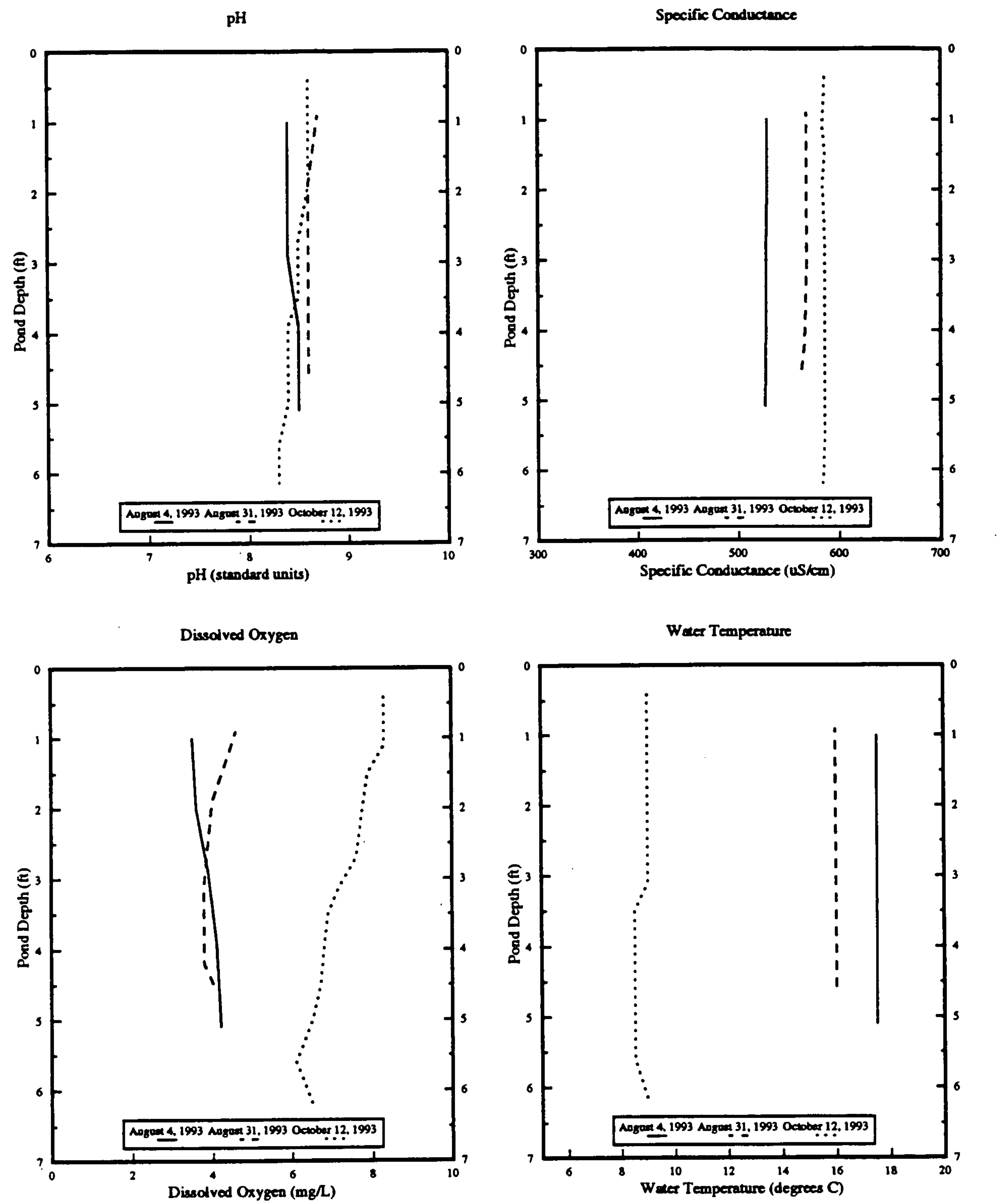
RFP, OU5 RFI/RI, TM15
AMENDED FIELD SAMPLING PLAN

FIGURE 2.6.2.1-1

DRAWN	5/11/94 DATE
CHECKED	5/11/94 DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

File: F2621-1.DRW

Status: 4/20/94



Source: EG&G 1994a, Appendix Table J-5

DEPTH-PROFILE DATA, POND C-2
1993 HYDROLAB MEASUREMENTS

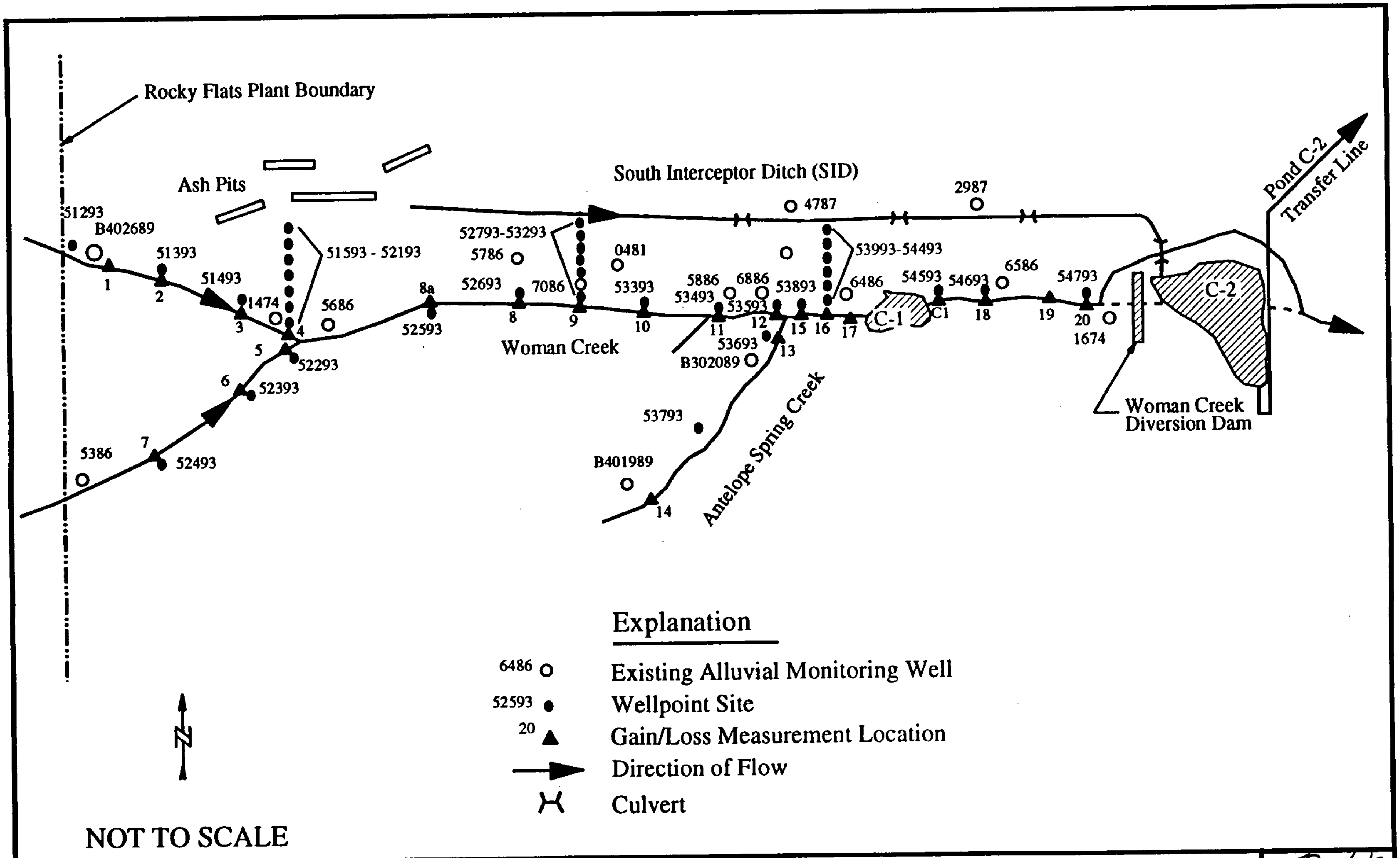
RFP, OU5 RFI/RI, TM15
AMENDED FIELD SAMPLING PLAN FIGURE 2.6.2.1-2

DRAWN 5/11/94 DATE
CHECKED 5/11/94 DATE
APPROVED EG&G DATE
APPROVED DOE DATE

EG&G

File: F2621-2.DRW

Status: 04/20/94



Location of Shallow Wellpoint Monitoring Sites and Gain/Loss Measurement Sites
Woman Creek Drainage Basin

EG&G

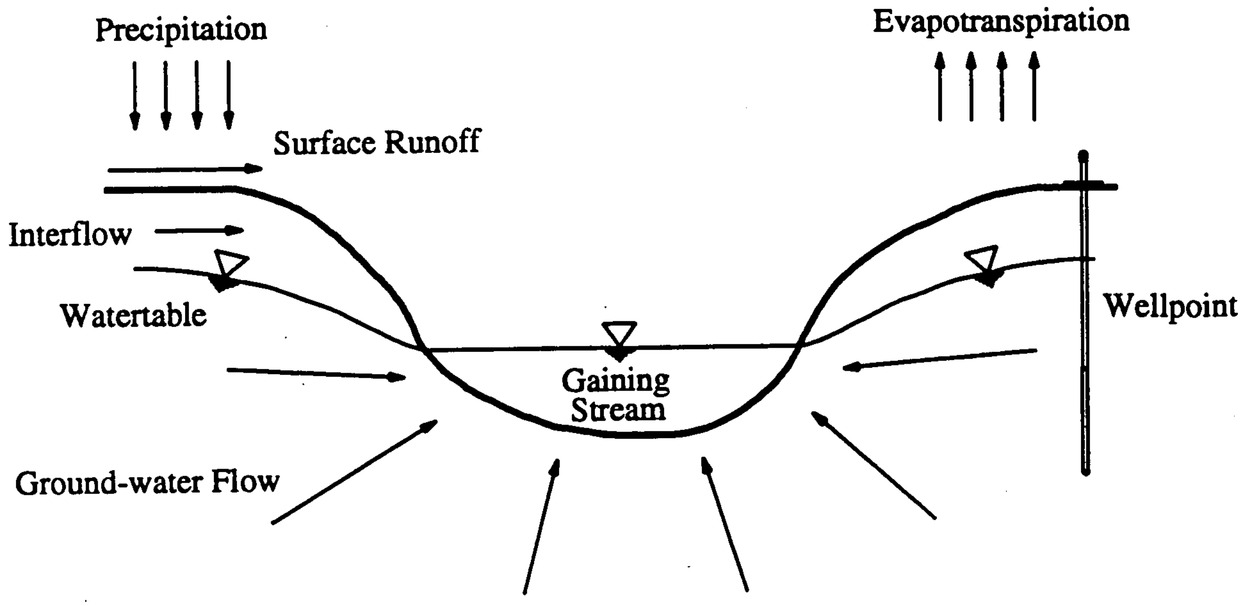
RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

FIGURE 2.6.2.2-1

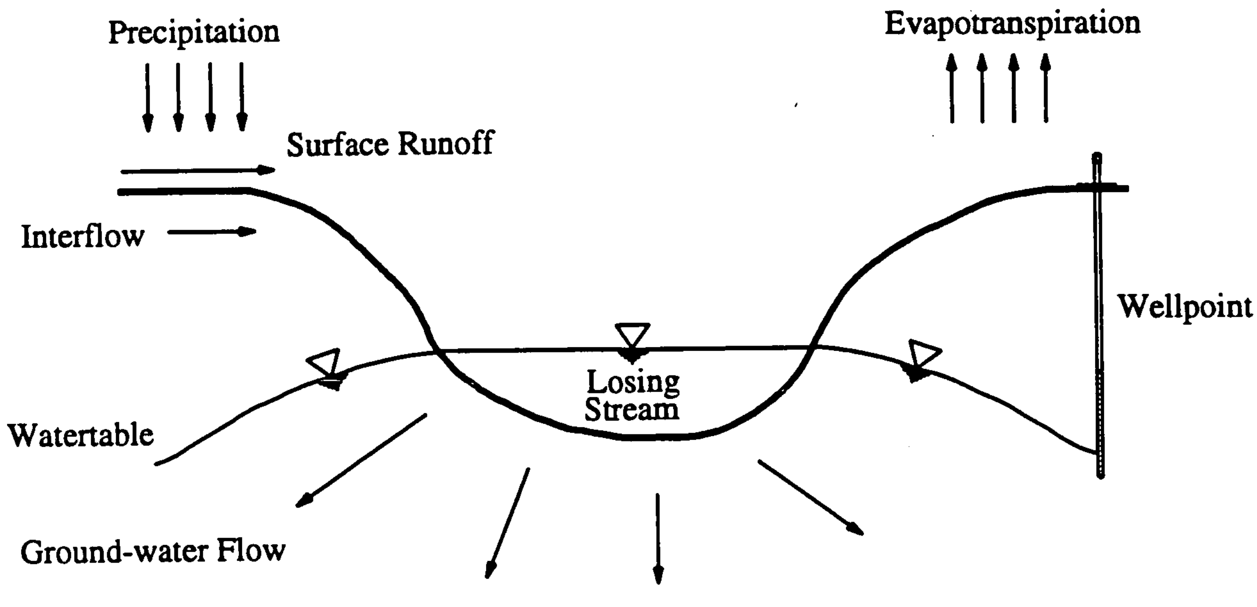
DRAWN TP 5/11/94 DATE
CHECKED DATE
APPROVED EG&G DATE
APPROVED DOE DATE

FILE: F2622-1.DRW

Status: 04/20/94



A. Schematic of a Gaining Stream



B. Schematic of a Losing Stream

Conceptual Definition of Gaining and Losing Streams

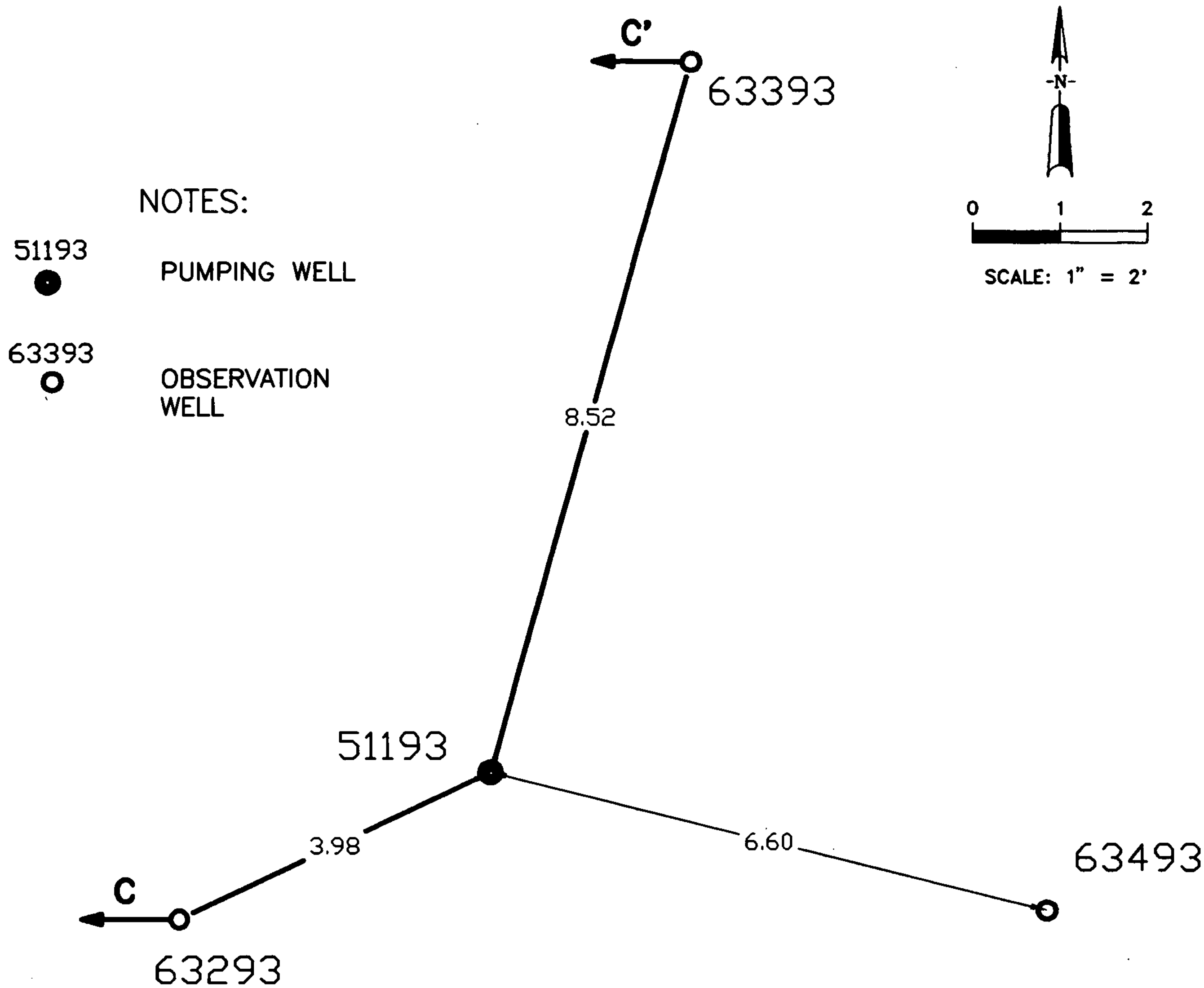
RFP, OU5 RFI/RI, TM15
WOMAN CREEK PRIORITY DRAINAGE

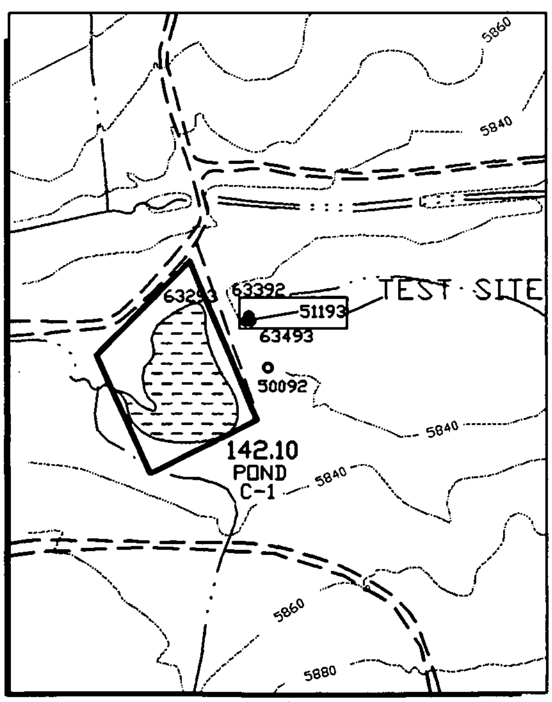
Figure 2.6.2.2-2

DRAWN 5/11/94	DATE
CHECKED 5/11/94	DATE
APPROVED EG&G	DATE
APPROVED DOE	DATE

File: F2622-2.DRW

Status: 04/20/94





Drawn N.M	5/11/94 Date
Checked	5/11/94 Date
Approved EG&G	Date
Approved DOE	Date

AQUIFER PUMPING TEST SITE MAP IHSS 142

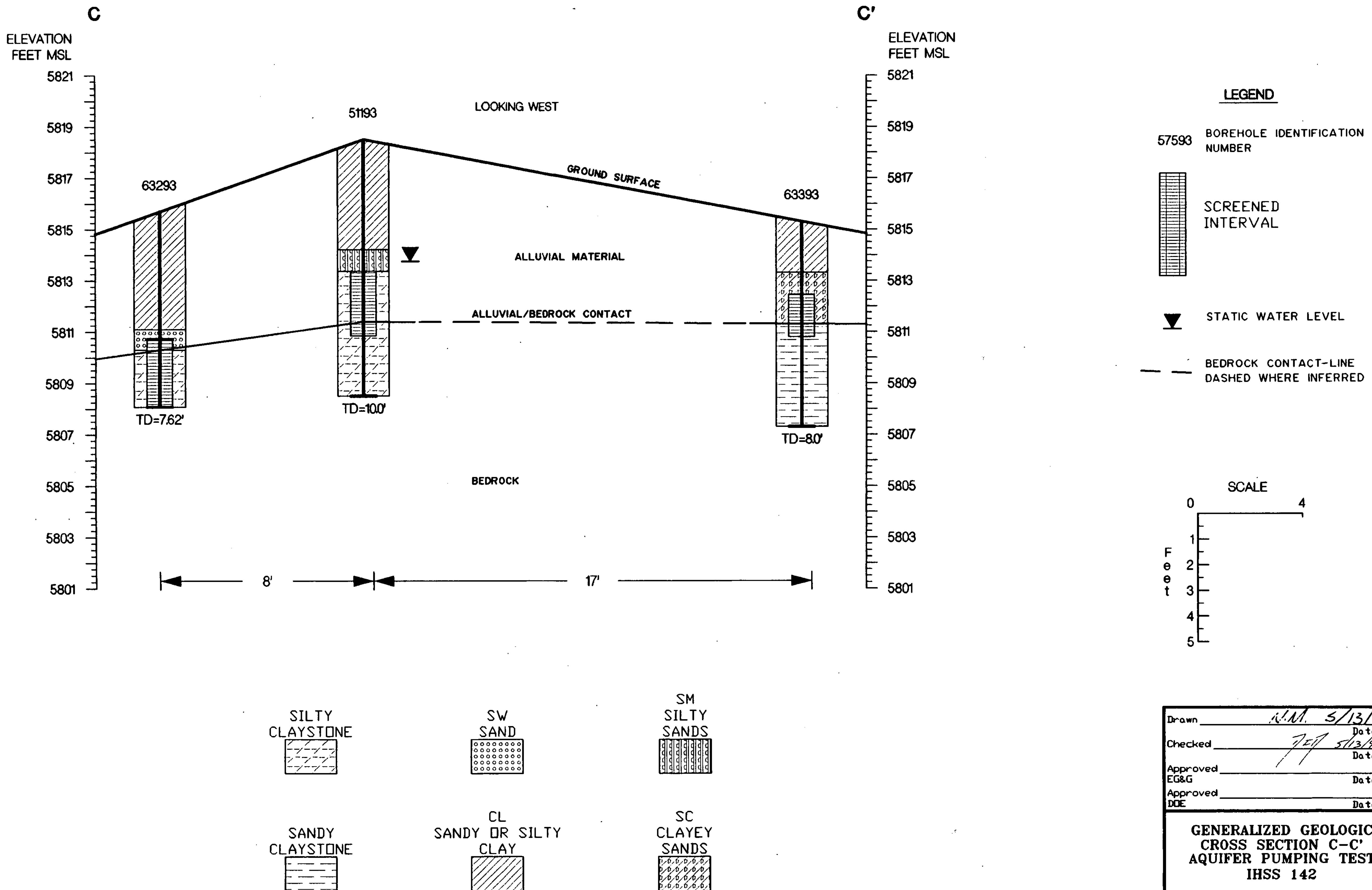
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.6.3.1-4

2631-4.DWG



NOTE: SEE FIGURE 2.6.3.1-4 FOR CROSS SECTION LOCATION

Drawn N.M.	Date 5/13/94
Checked	Date 5/13/94
Approved EG&G	Date
Approved DOE	Date

GENERALIZED GEOLOGIC CROSS SECTION C-C' AQUIFER PUMPING TEST IHSS 142

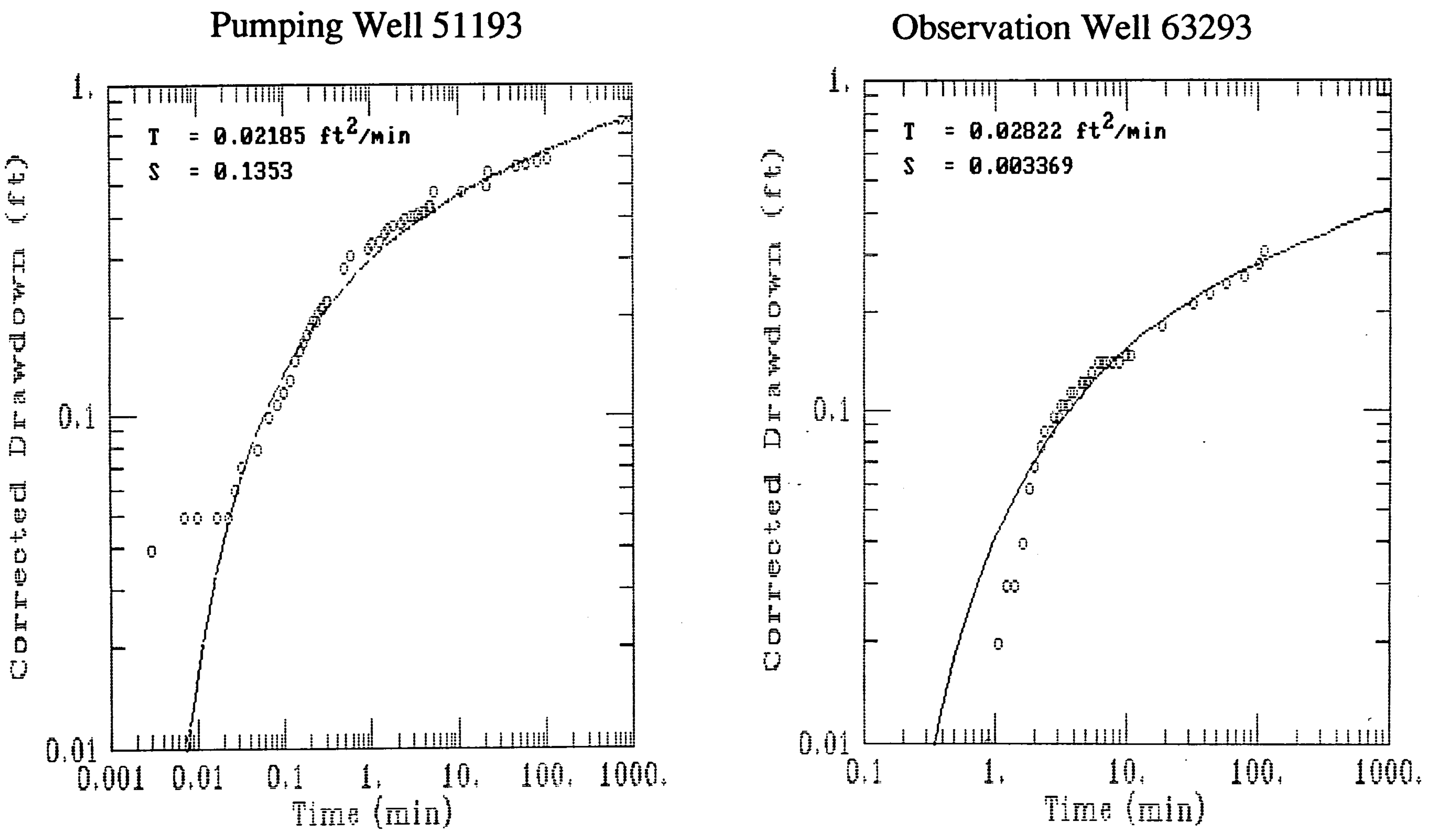
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.6.3.1-5

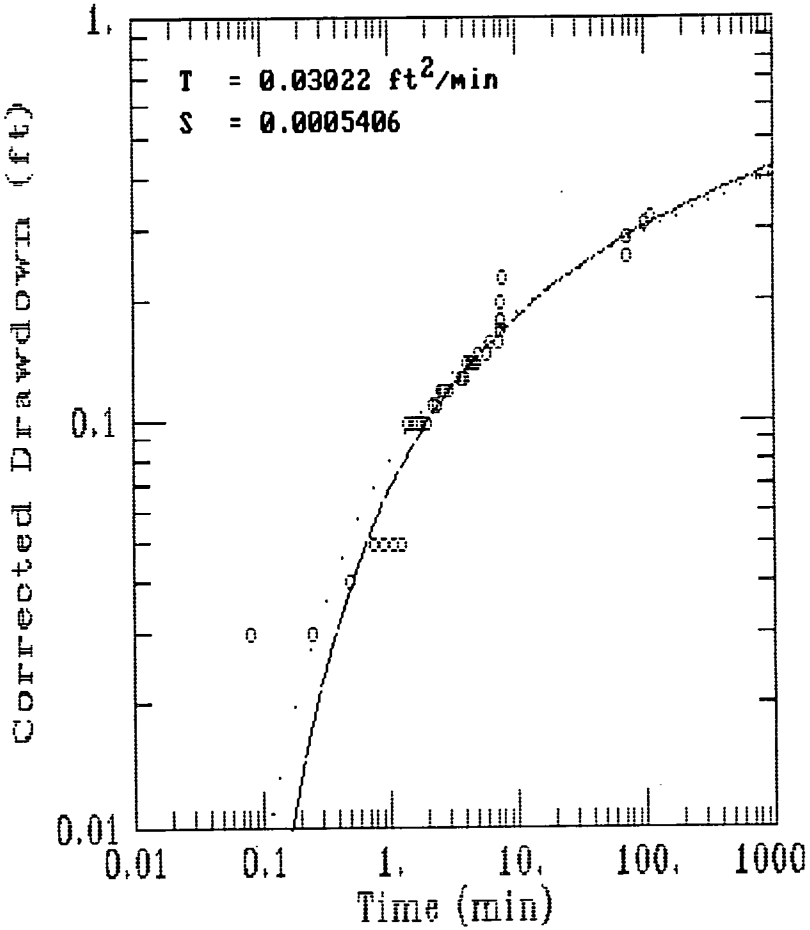
2831-5DWG



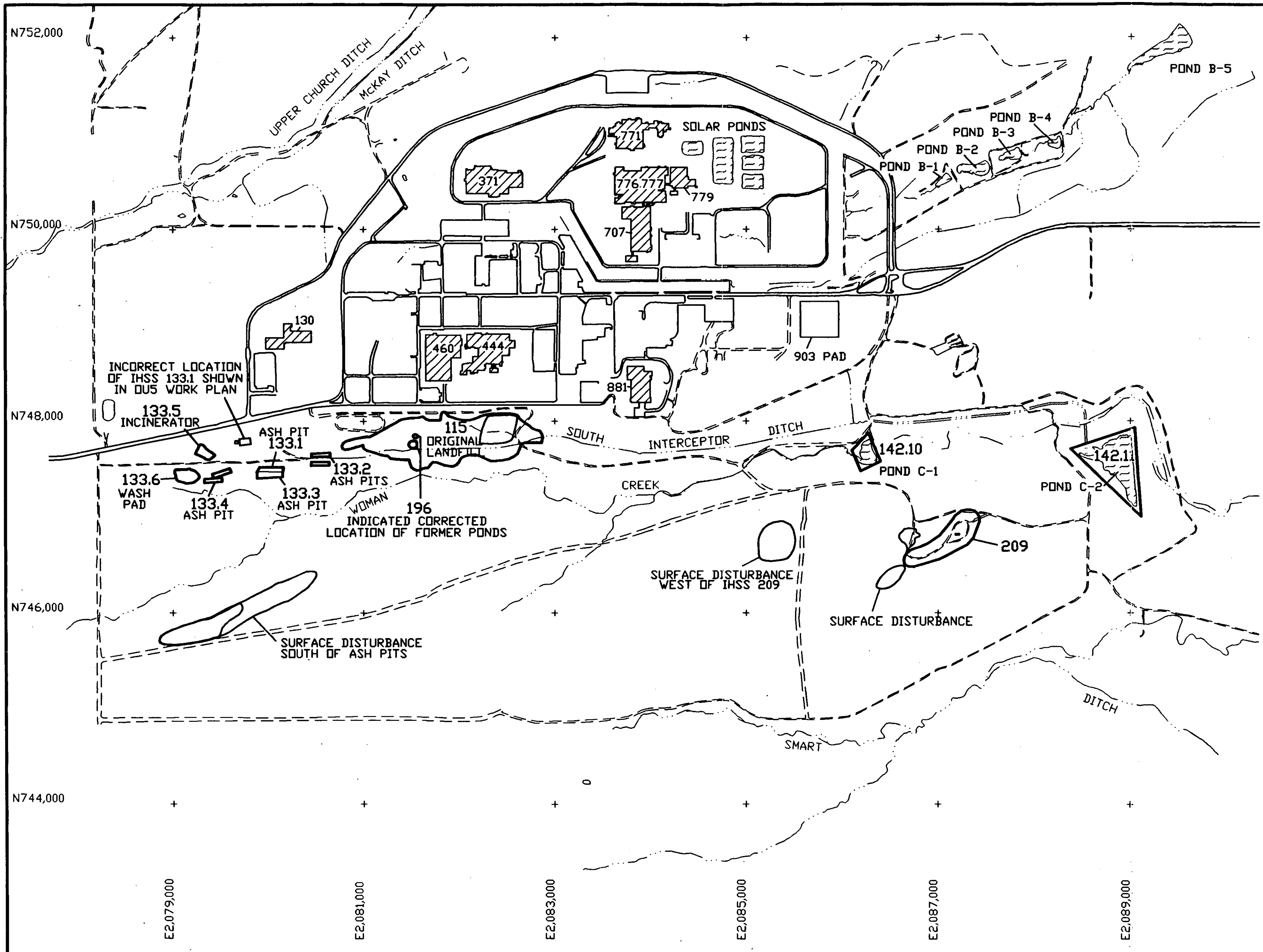
IHSS 142
AQUIFER TEST DATA ANALYSIS
TEST DATE: AUGUST 5, 1993
PW51193 AND OW63293

DRAWN ______ DATE	TM15 - AMENDED FIELD SAMPLING PLAN
CHECKED ______ DATE	OU5 PHASE I RFI/RI IMPLEMENTATION
APPROVED EG&G ______ DATE	EG&G — MAY 1994 — FIGURE 2.6.3.1-6
APPROVED DOE ______ DATE	

Observation Well 63493



DRAWN ______ DATE	IHSS 142 AQUIFER TEST DATA ANALYSIS TEST DATE: AUGUST 5, 1993 OW63493
CHECKED ______ DATE	TM15 - AMENDED FIELD SAMPLING PLAN
APPROVED EG&G ______ DATE	OU5 PHASE I RFI/RI IMPLEMENTATION
APPROVED DOE ______ DATE	EG&G — MAY 1994 — FIGURE 2.6.3.1-7



MAP LEGEND

- STREAMS, DITCHES, DRAINAGE FEATURES
- PAVED ROADS
- DIRT ROADS
- SURFACE WATER IMPOUNDMENTS
- BUILDINGS
- INDIVIDUAL HAZARDOUS SUBSTANCE SITES (APPROXIMATE LOCATION)

-N-

0 500 1000

SCALE: 1" = 1000'

Drawn N.M. 5/11/94 Date
Checked 5/11/94 Date
Approved EG&G Date
Approved DOE Date

WOMAN CREEK PRIORITY DRAINAGE AREA (OPERABLE UNIT No. 5)

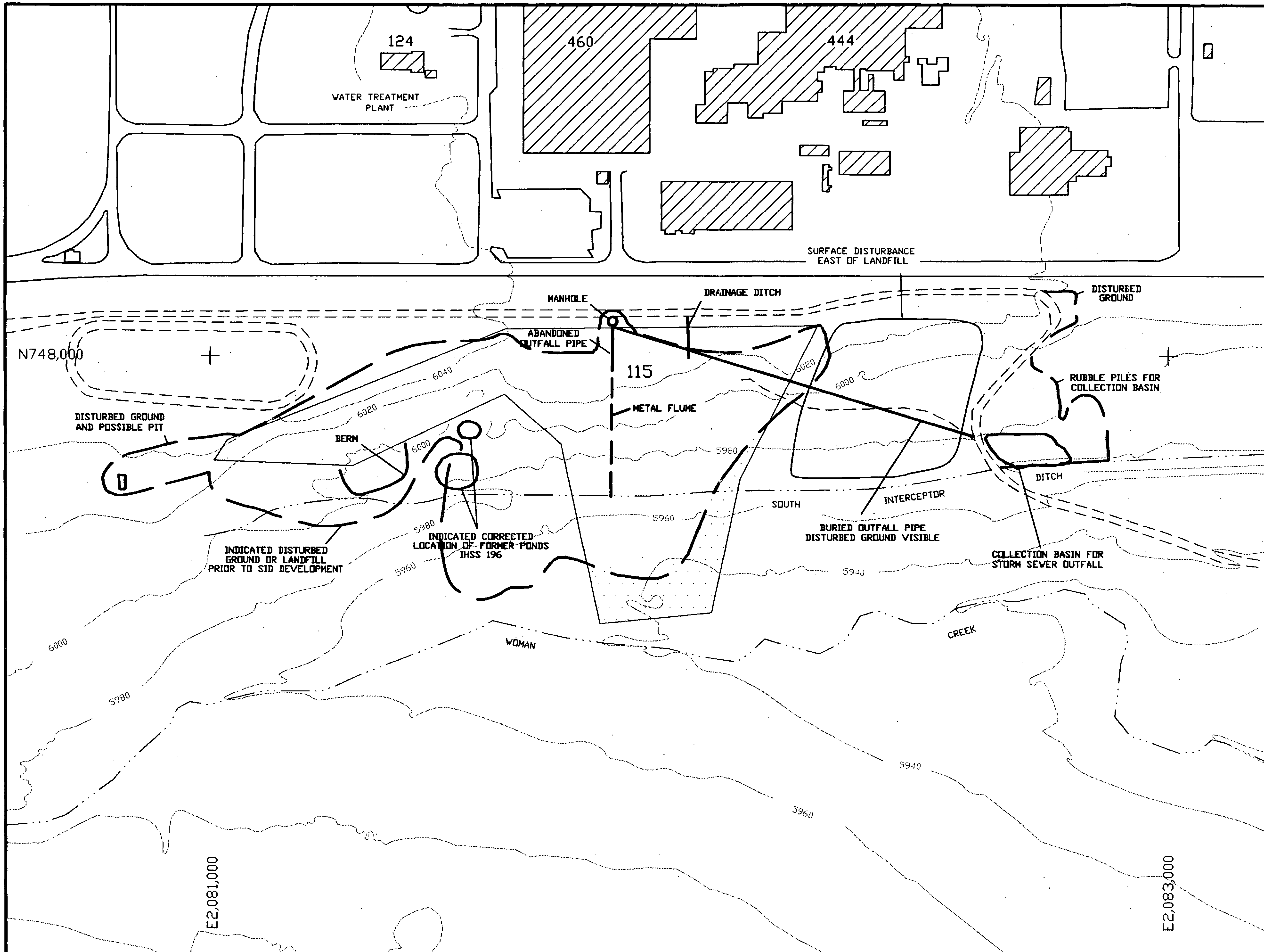
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 1.2-1

12-1.DWG



MAP LEGEND

STREAMS, DITCHES, DRAINAGE FEATURES

PAVED ROADS

DIRT ROADS

BUILDINGS

115 IHSS 115 ORIGINAL LANDFILL BOUNDARY (DOE, 1992a)

AMENDED LANDFILL BOUNDARY BASED ON AERIAL PHOTO REVIEW

EPA AND CDH SOUTHERN EXTENSION OF LANDFILL BOUNDARY (DOE, 1992a) INCLUDED IN THIS STUDY

-N-

0 100 200

SCALE: 1" = 200'

Drawn NM.	5/11/94 Date
Checked TH	5/11/94 Date
Approved EG&G	Date
Approved DOE	Date

IHSS 115 ORIGINAL LANDFILL AND EXTENDED AREAS AND IHSS 196 FILTER BACKWASH POND

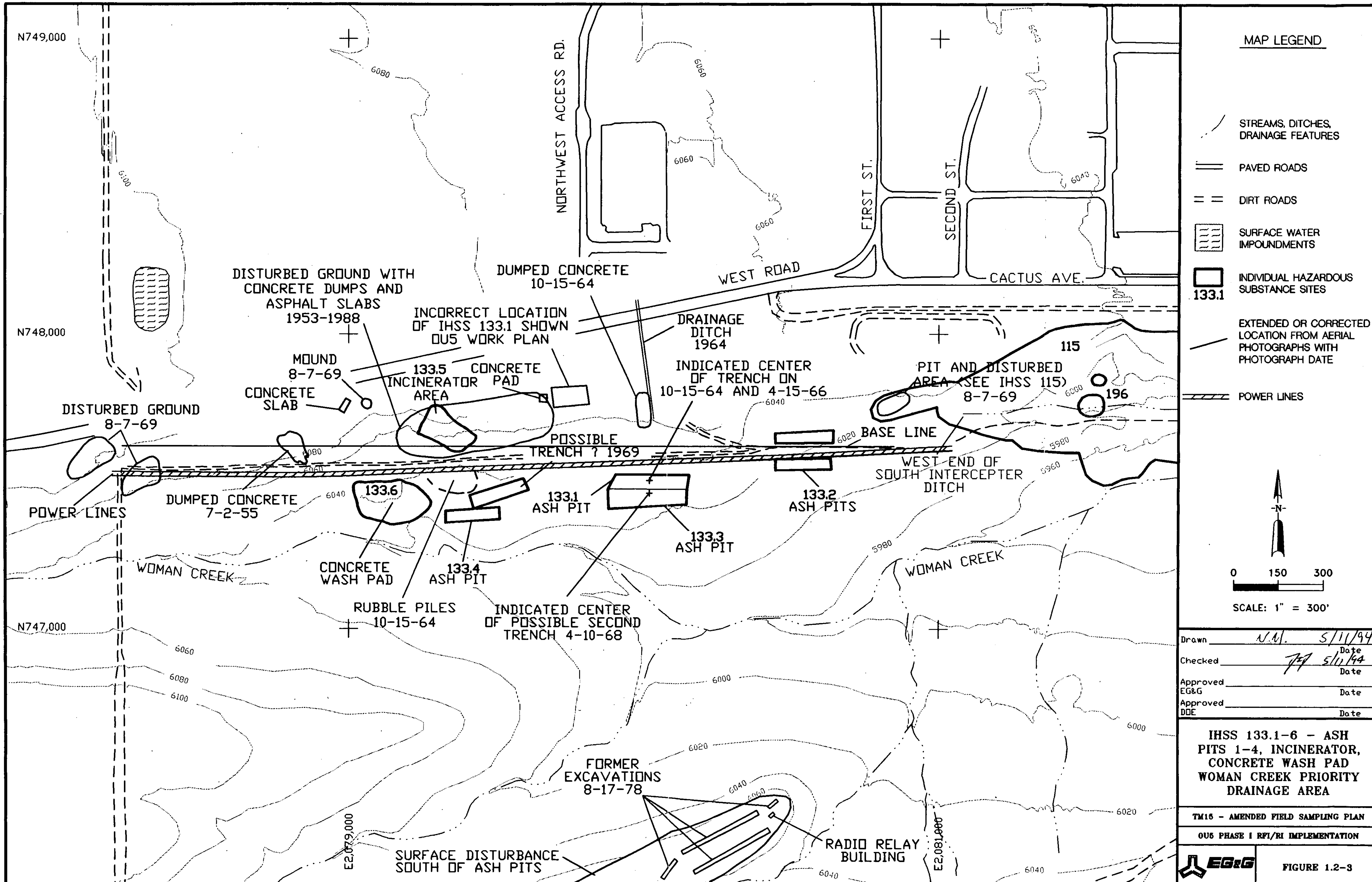
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

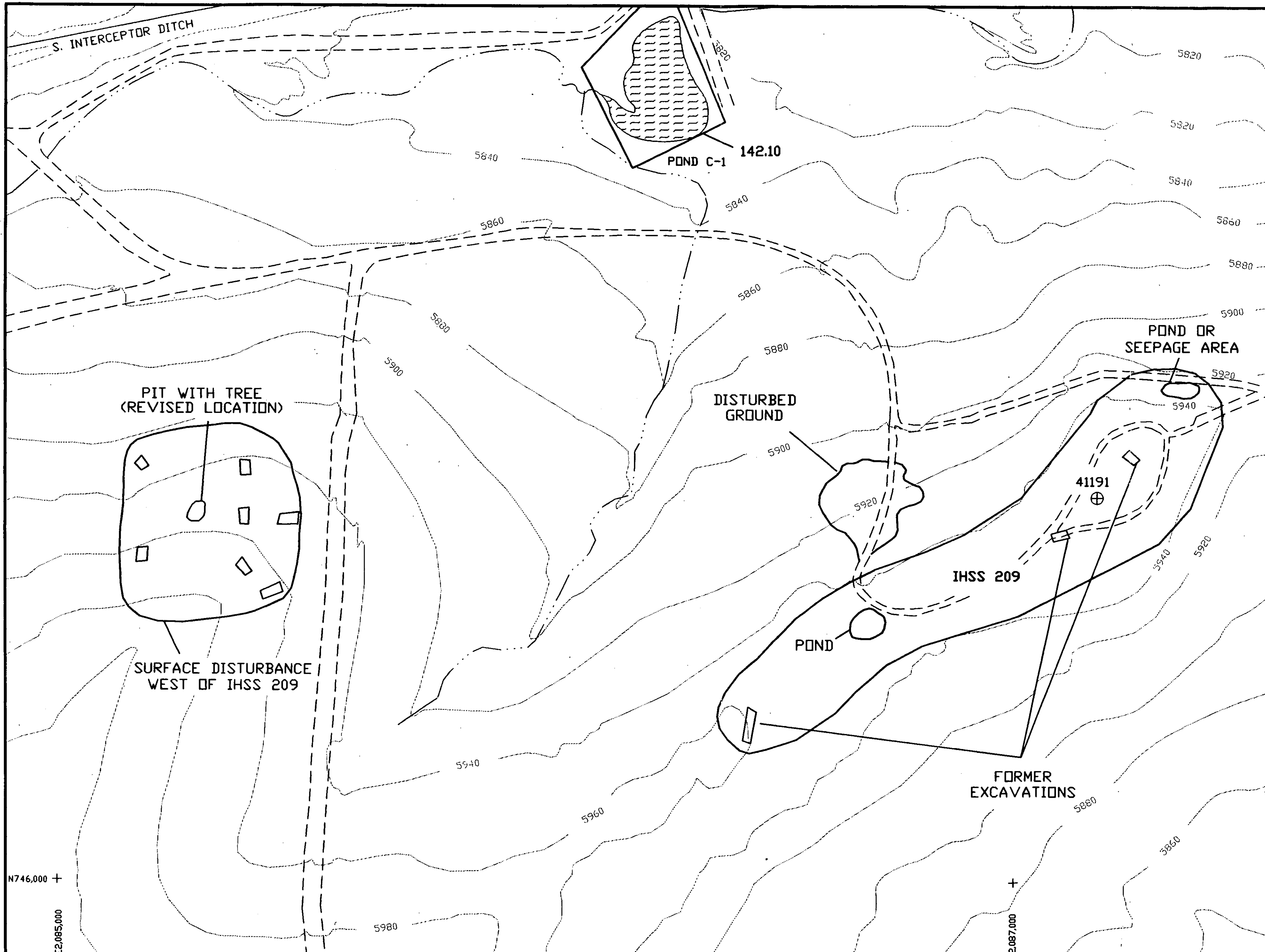
EG&G

FIGURE 1.2-2

12-2.DWG


N749,000
N748,000
N747,000
E2,079,000
E2,081,000
NORTHWEST ACCESS RD.
FIRST ST.
SECOND ST.
WEST ROAD
CACTUS AVE.
DISTURBED GROUND WITH CONCRETE DUMPS AND ASPHALT SLABS 1953-1988
DUMPED CONCRETE 10-15-64
INCORRECT LOCATION OF IHSS 133.1 SHOWN OU5 WORK PLAN
DRAINAGE DITCH 1964
MOUND 8-7-69
133.5 INCINERATOR AREA
CONCRETE PAD
CONCRETE SLAB
INDICATED CENTER OF TRENCH ON 10-15-64 AND 4-15-66
PIT AND DISTURBED AREA (SEE IHSS 115) 8-7-69
115
196
DISTURBED GROUND 8-7-69
POSSIBLE TRENCH ? 1969
BASE LINE
WEST END OF SOUTH INTERCEPTER DITCH
133.6
133.1 ASH PIT
133.2 ASH PITS
133.3 ASH PIT
POWER LINES
DUMPED CONCRETE 7-2-55
CONCRETE WASH PAD
133.4 ASH PIT
WOMAN CREEK
WOMAN CREEK
RUBBLE PILES 10-15-64
INDICATED CENTER OF POSSIBLE SECOND TRENCH 4-10-68
FORMER EXCAVATIONS 8-17-78
RADIO RELAY BUILDING
SURFACE DISTURBANCE SOUTH OF ASH PITS
6100
6080
6060
6040
6020
6000
5980
5960
MAP LEGEND
STREAMS, DITCHES, DRAINAGE FEATURES
PAVED ROADS
DIRT ROADS
SURFACE WATER IMPOUNDMENTS
133.1
INDIVIDUAL HAZARDOUS SUBSTANCE SITES
EXTENDED OR CORRECTED LOCATION FROM AERIAL PHOTOGRAPHS WITH PHOTOGRAPH DATE
POWER LINES
N
0 150 300
SCALE: 1" = 300'
Drawn N.N. 5/11/94 Date
Checked 5/11/94 Date
Approved EG&G Date
Approved DOE Date
IHSS 133.1-6 - ASH PITS 1-4, INCINERATOR, CONCRETE WASH PAD WOMAN CREEK PRIORITY DRAINAGE AREA
TM15 - AMENDED FIELD SAMPLING PLAN
OU5 PHASE I RFI/RI IMPLEMENTATION
EG&G
FIGURE 1.2-3

12-3.DWG



MAP LEGEND

- STREAMS, DITCHES, DRAINAGE FEATURES
- DIRT ROADS
- SURFACE WATER IMPOUNDMENTS
- REVISED PIT LOCATIONS
- 209 INDIVIDUAL HAZARDOUS SUBSTANCE SITES (IHSS)
- 41191 EXISTING BOREHOLE

N

0 100 200

SCALE: 1" = 200'

Drawn	N.M.	5/11/94 Date
Checked	[signature]	5/11/94 Date
Approved EG&G		Date
Approved DOE		Date

IHSS 209 &
SURFACE DISTURBANCE
WEST OF IHSS 209
LOCATION MAP

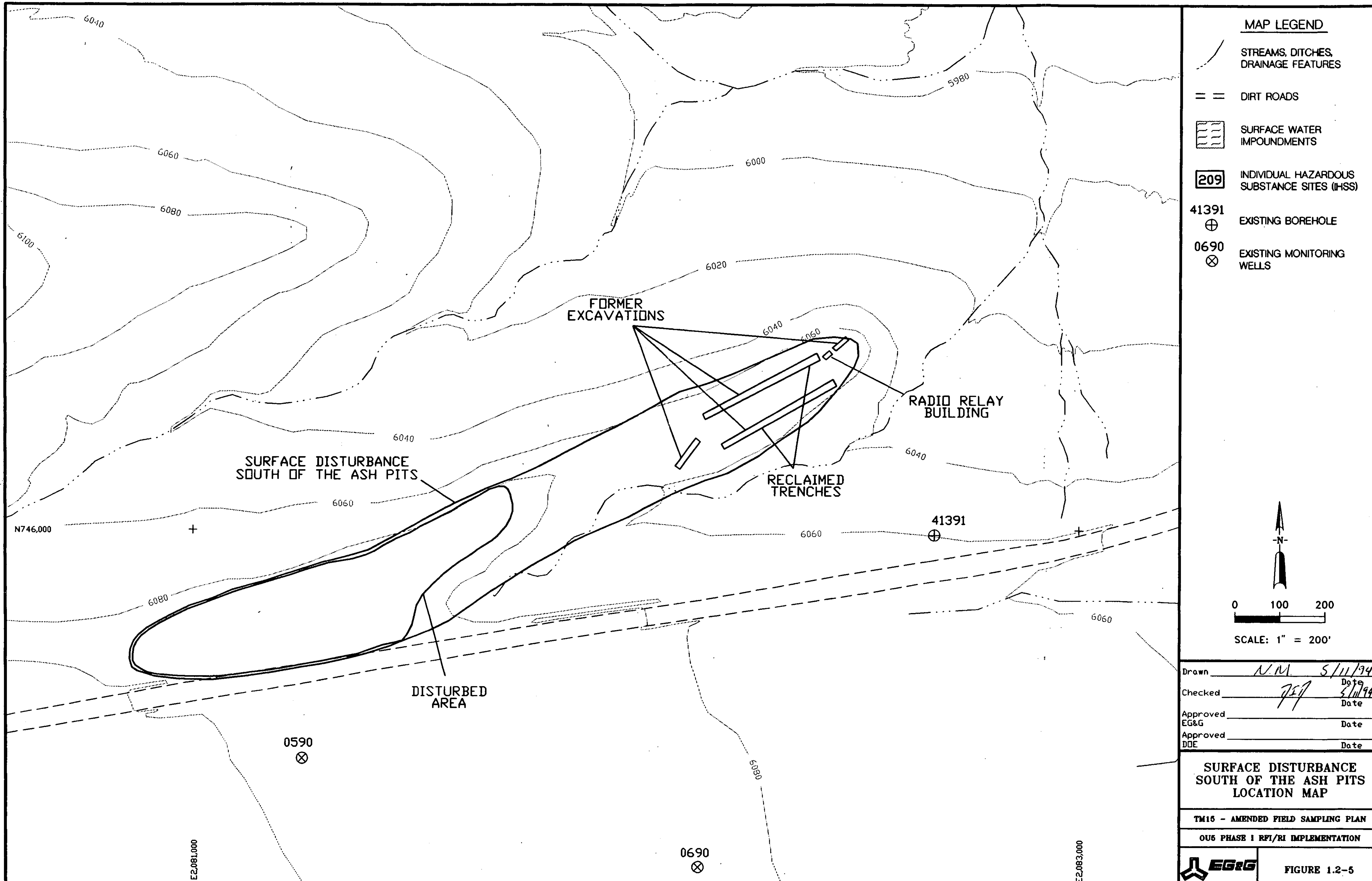
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 1.2-4

12-4.DVG



Drawn N.M.	5/11/94 Date
Checked JEJ	5/11/94 Date
Approved EG&G	Date
Approved DOE	Date

SURFACE DISTURBANCE SOUTH OF THE ASH PITS LOCATION MAP

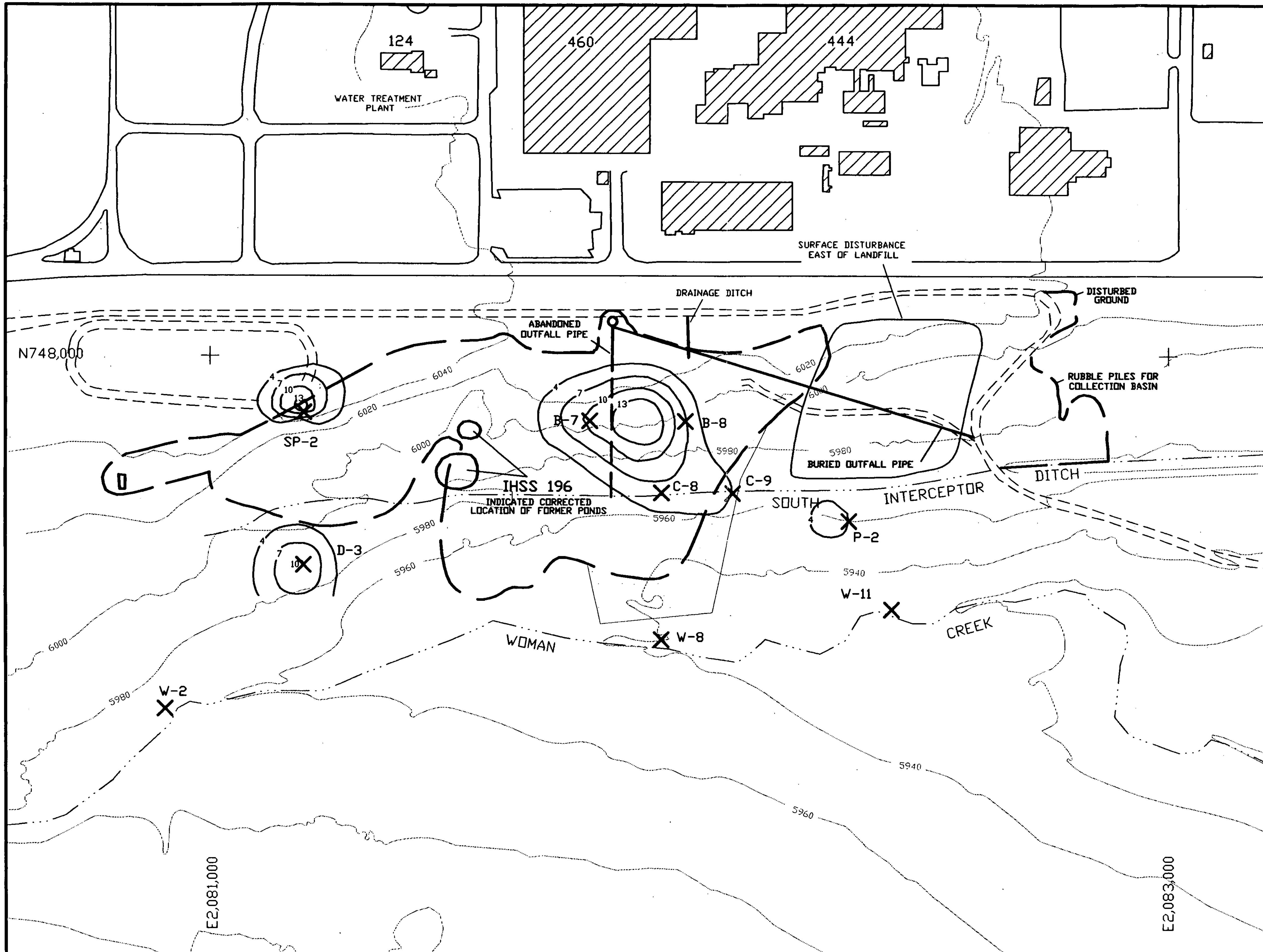
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 1.2-5

12-5.DWG



Drawn NM	5/11/94 Date
Checked TEJ	5/11/94 Date
Approved EG&G	Date
Approved DOE	Date

IHSS 115, ORIGINAL LANDFILL, AND IHSS 196, FILTER BACKWASH POND HPGe SURVEY HOT SPOTS

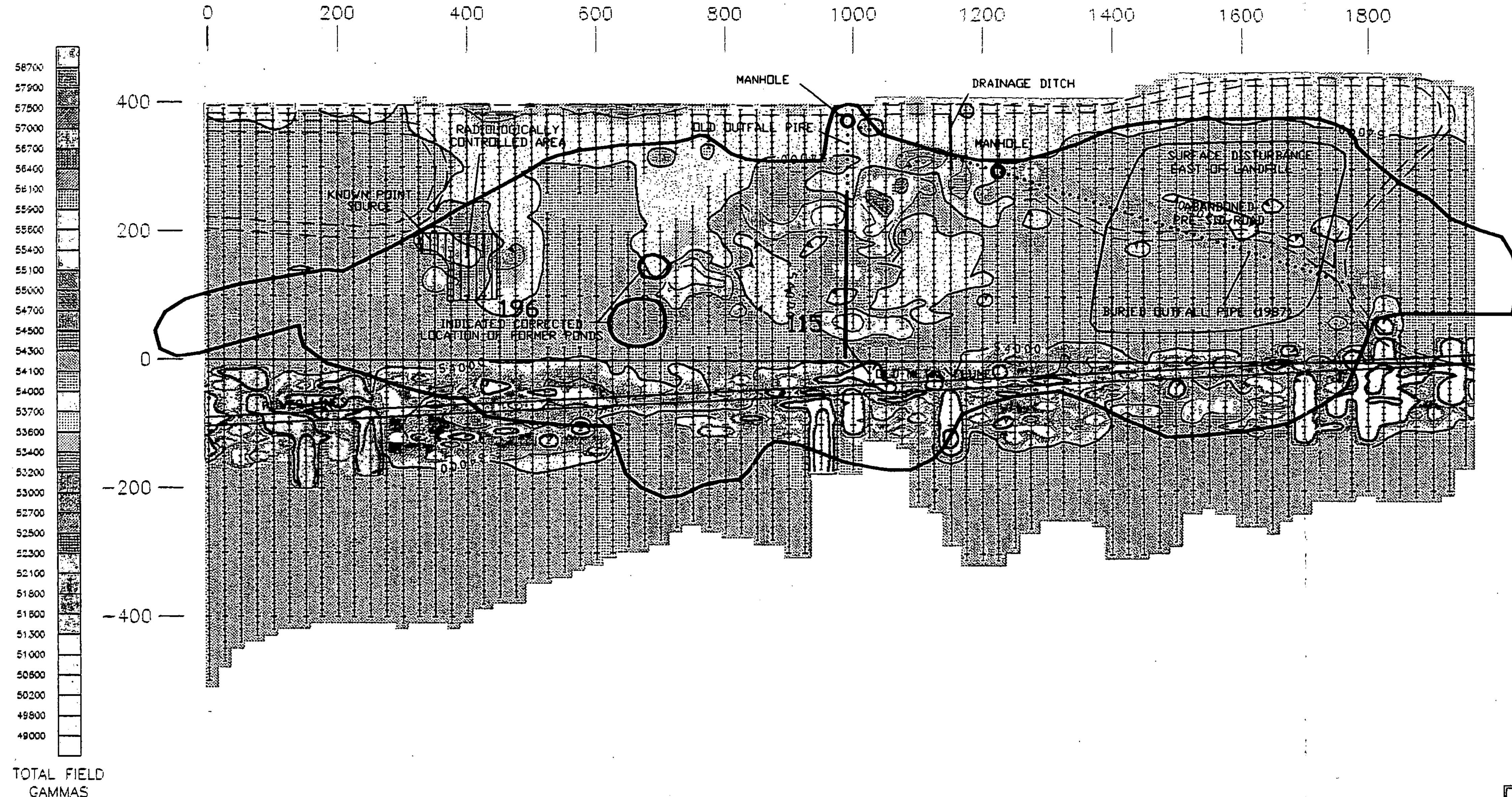
TM15 - AMENDED FIELD SAMPLING PLAN

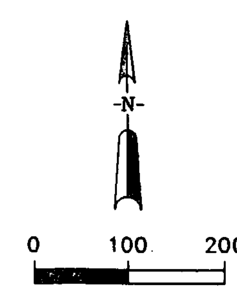
OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.4.1-1

241-1.DWG





SCALE: 1" = 200'

Drawn ______ Date	
Checked ______ Date	
Approved EG&G ______ Date	
Approved DOE ______ Date	

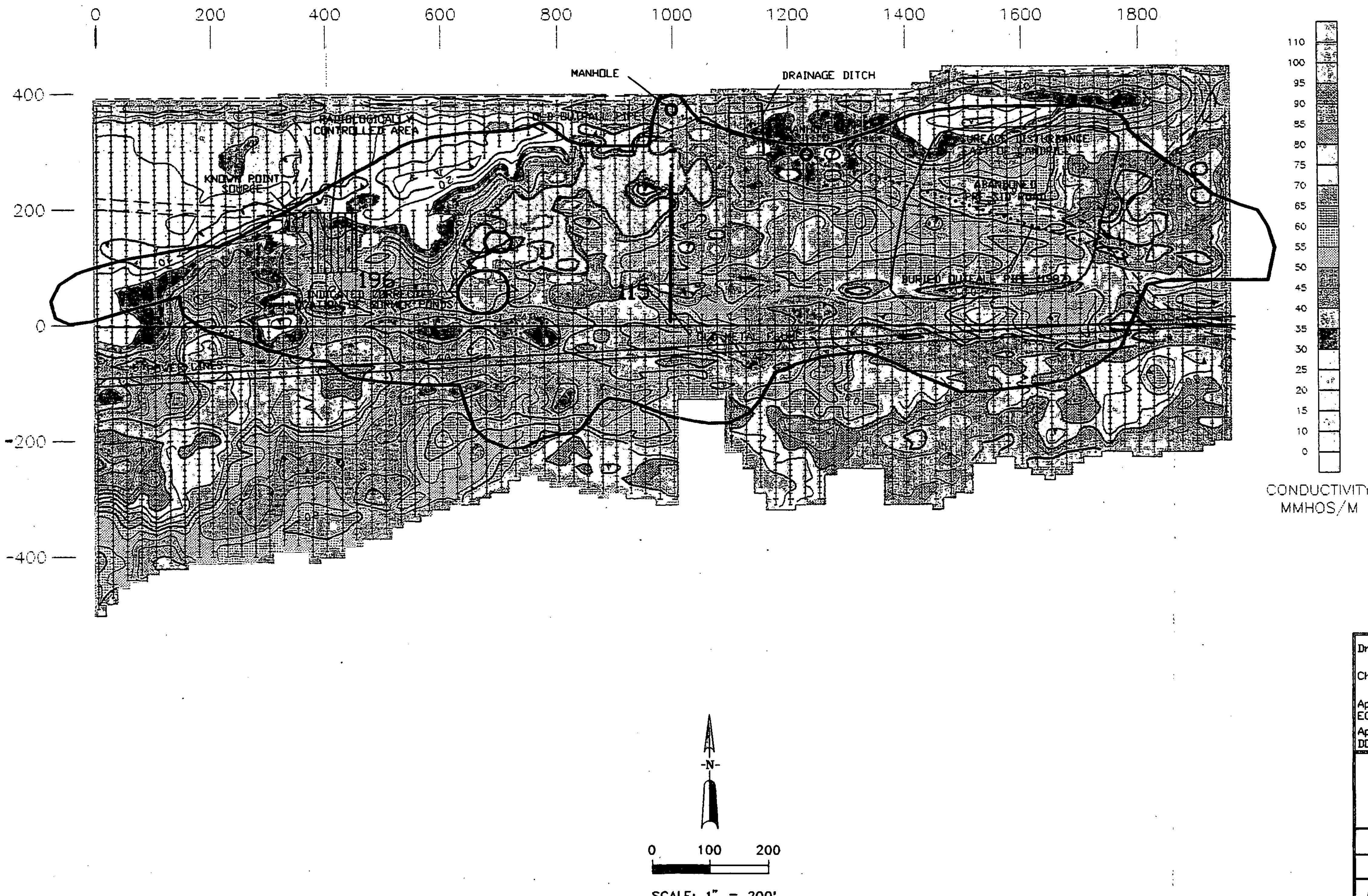
TOTAL MAGNETIC FIELD
IHSS 115

TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G — FIGURE 2.4.2.1-1

2421-1.DWG



Drawn ______ Date

Checked ______ Date

Approved EG&G ______ Date

Approved DOE ______ Date

EM 31 CONDUCTIVITY (QUADRATURE PHASE) VERTICAL DIPOLE

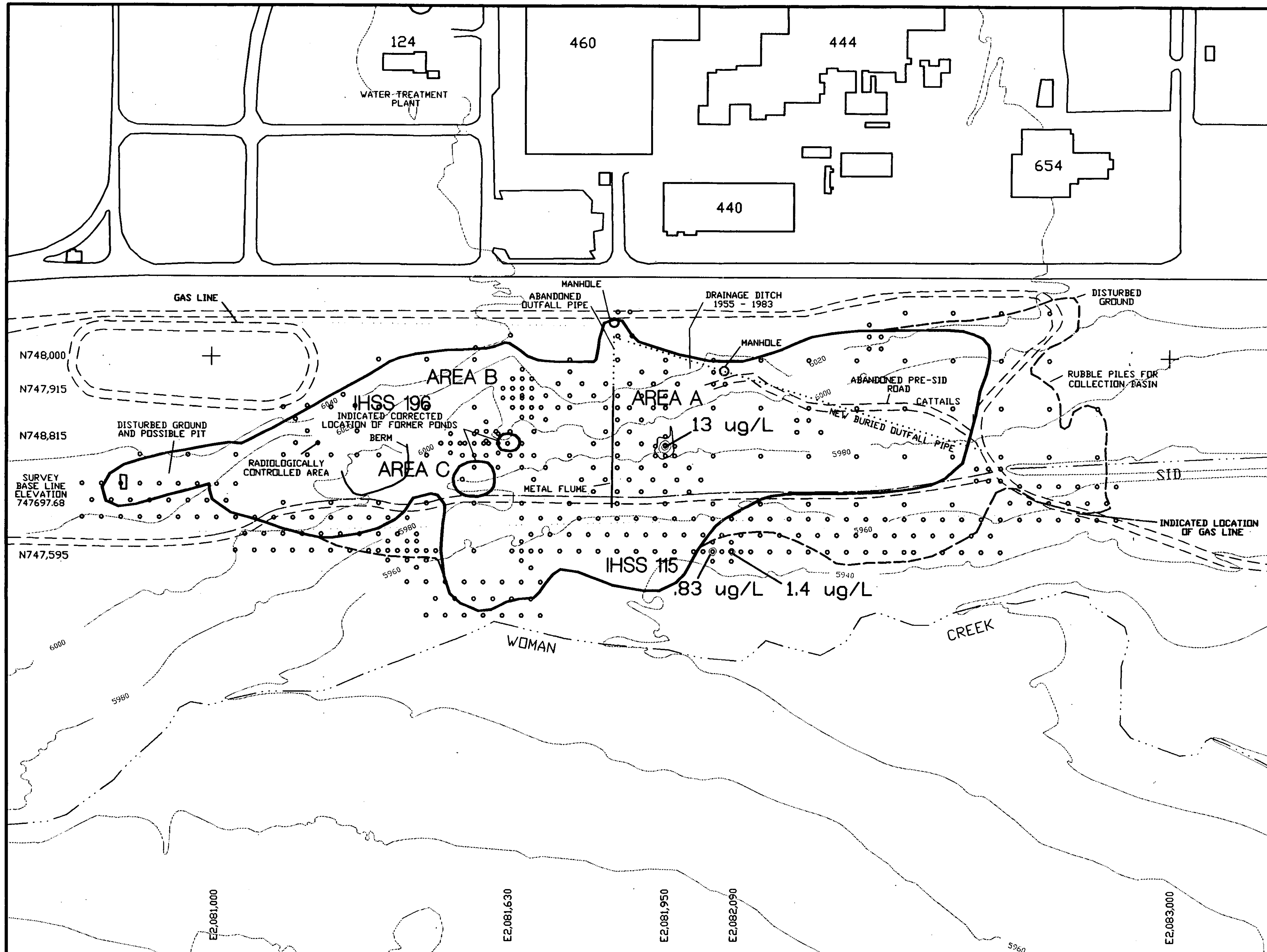
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.4.2.1-2

2421-1.DWG



MAP LEGEND

STREAMS, DITCHES, DRAINAGE FEATURES

PAVED ROADS

DIRT ROADS

440 BUILDINGS

115 ORIGINAL LANDFILL AND SURFACE DISTURBANCE, (PRE - SID)

LANDFILL AND DISTURBANCE (POST - SID)

SOIL GAS SAMPLE LOCATION

REPORTING LIMIT = 2.0 ug/L

3x DETECTION LIMIT = 0.75 ug/L

CONTOUR INTERVAL = 5

13 = MAXIMUM CONCENTRATION ug/L

-N-

0 100 200

SCALE: 1" = 200'

Drawn	N.M.	5/11/94 Date
Checked	T.J.J.	5/11/94 Date
Approved EG&G		Date
Approved DOE		Date

SOIL GAS SURVEY RESULTS FOR 1,1,1-TRICHLOROETHANE (1,1,1-TCA) IHSS 115/196

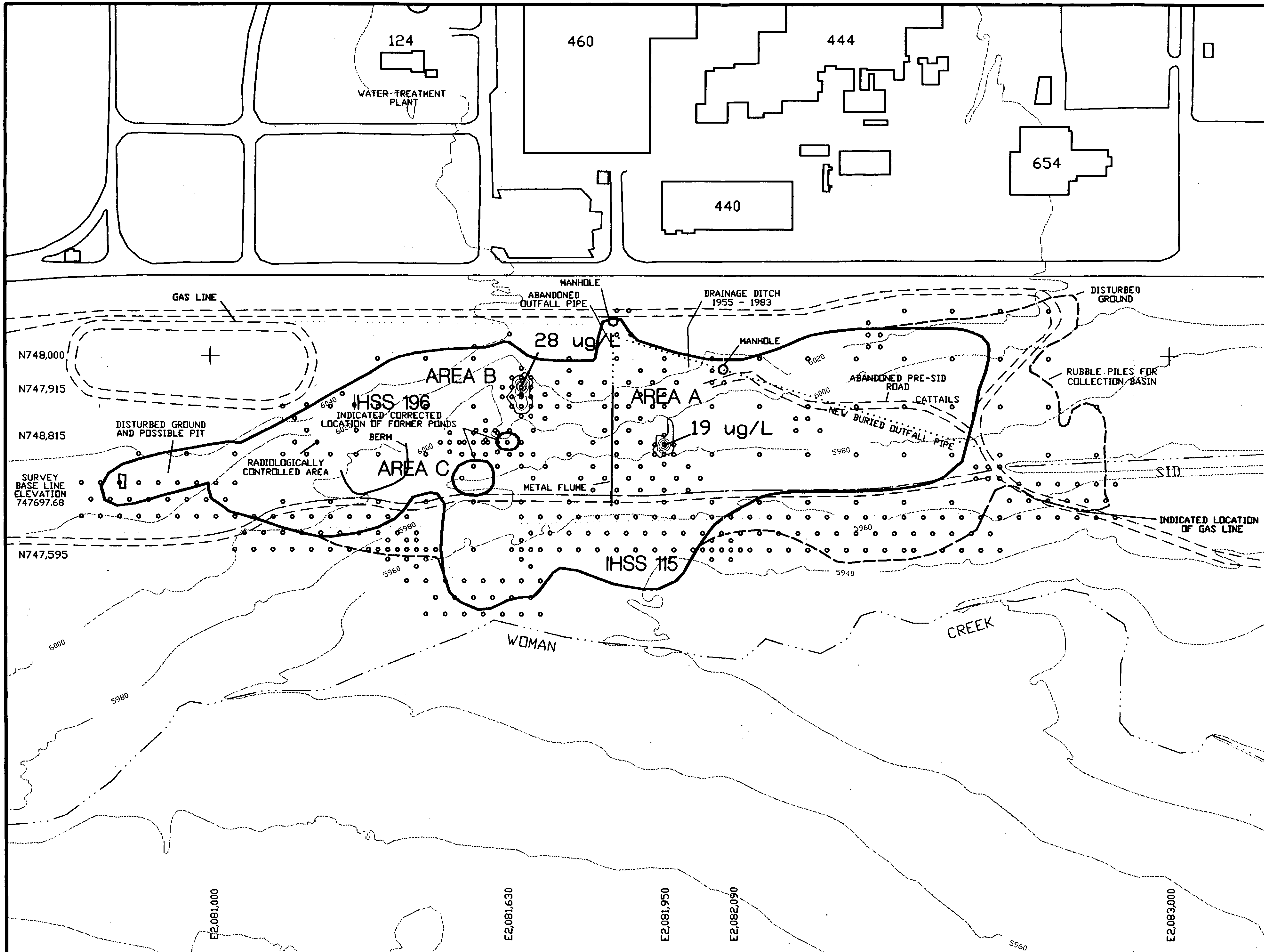
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.4.2.2-1

2422-1.DWG



MAP LEGEND

- STREAMS, DITCHES, DRAINAGE FEATURES
- PAVED ROADS
- DIRT ROADS
- 440 BUILDINGS
- 115 ORIGINAL LANDFILL AND SURFACE DISTURBANCE, (PRE - SID)
- LANDFILL AND DISTURBANCE (POST - SID)
- SOIL GAS SAMPLE LOCATION

REPORTING LIMIT = 10 ug/L
3x DETECTION LIMIT = 0.75 ug/L
CONTOUR INTERVAL = 5

28, 19 = MAXIMUM CONCENTRATIONS ug/L

N

0 100 200

SCALE: 1" = 200'

Drawn N.M. 5/11/94 Date
Checked [signature] 5/11/94 Date
Approved EG&G Date
Approved DOE Date

SOIL GAS SURVEY RESULTS FOR TRICHLOROETHENE (TCE) IHSS 115/196

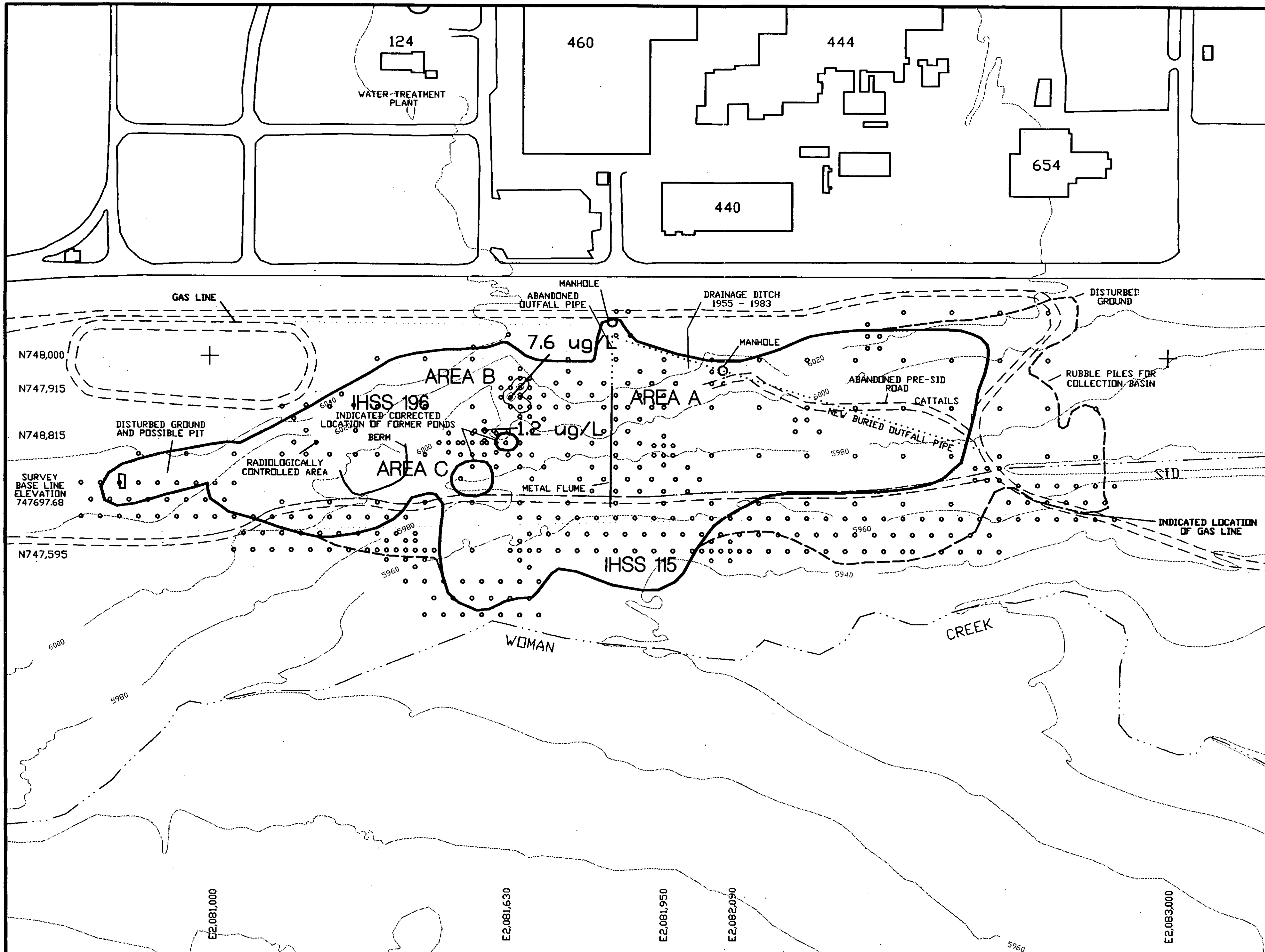
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.4.2.2-2

2422-1.DWG



Drawn N.M. 5/11/94
Date
Checked [signature] 5/11/94
Date
Approved EG&G
Date
Approved DOE
Date

SOIL GAS SURVEY RESULTS FOR TETRACHLOROETHENE (PCE) IHSS 115/196

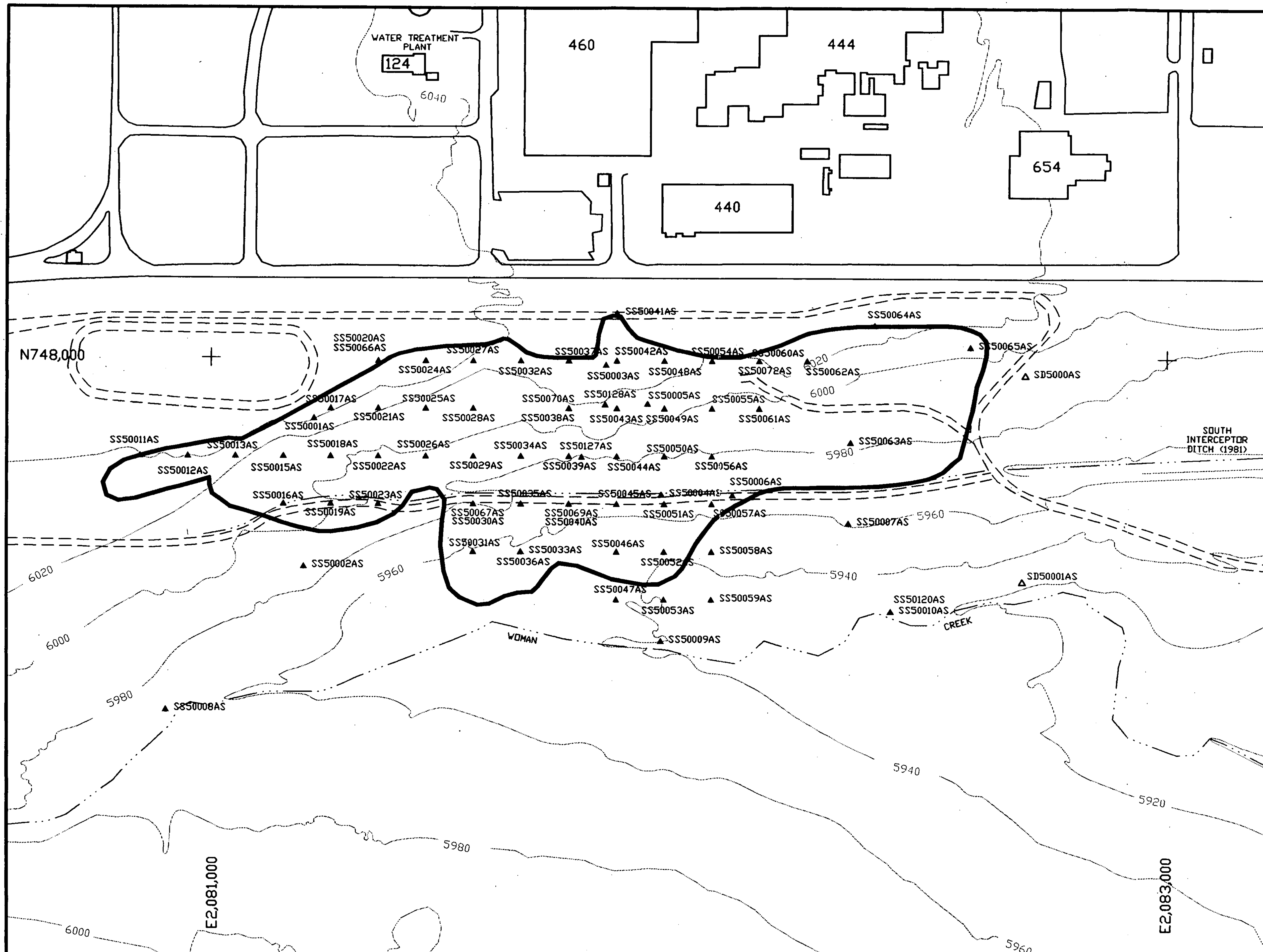
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.4.2.2-3

2422-1.DWG



MAP LEGEND

- STREAMS, DITCHES, DRAINAGE FEATURES
- PAVED ROADS
- DIRT ROADS
- LANDFILL BOUNDARY SURFACE DISTURBANCE, PRE - SID
- SS50053AS ▲ SURFACE SOIL SAMPLE LOCATIONS
- SD5000AS △ SEEP SEDIMENT SEEP SEDIMENT SAMPLE LOCATION

-N-

0 100 200

SCALE: 1" = 200'

Drawn	N.M.	5/11/94 Date
Checked	[illegible]	5/11/94 Date
Approved EG&G		Date
Approved DOE		Date

SURFACE SOIL AND SEEP SEDIMENT SAMPLE LOCATIONS IHSS 115

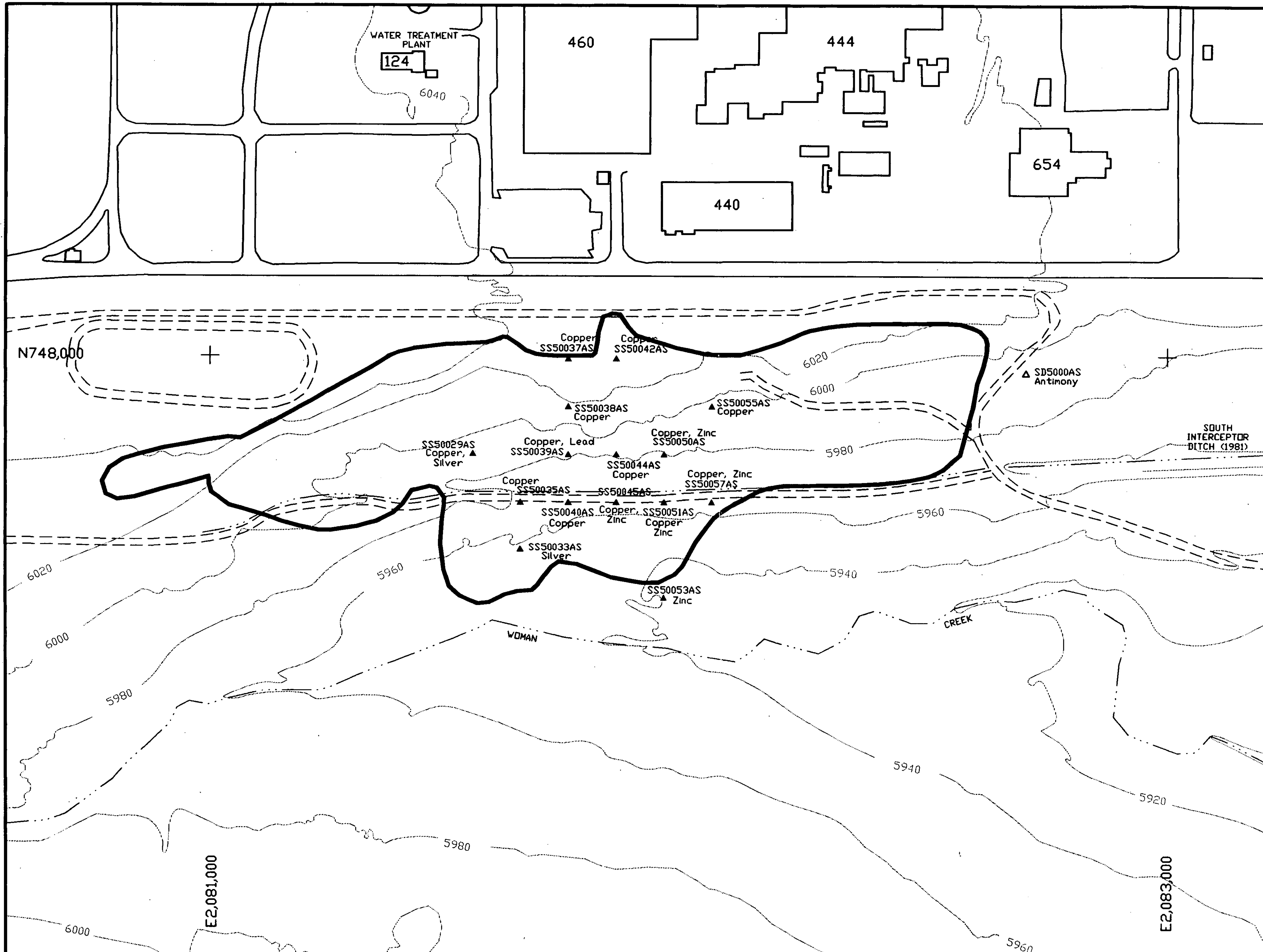
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.4.3.1-1

2431-1.DWG



MAP LEGEND

STREAMS, DITCHES, DRAINAGE FEATURES

PAVED ROADS

DIRT ROADS

LANDFILL BOUNDARY SURFACE DISTURBANCE, PRE - SID

SS50057AS ▲ Copper, Zinc — SURFACE SOIL SAMPLE LOCATION WITH ANALYTES ABOVE THE BUTL OR MAXIMUM BACKGROUND CONCENTRATION

SD5000AS △ Antimony — SEEP SEDIMENT SAMPLE LOCATION WITH ANALYTES ABOVE THE BUTL

NOTE: BUTL's FOR SILVER ARE NOT AVAILABLE. SILVER OCCURRED ABOVE MAXIMUM BACKGROUND CONCENTRATIONS AT THE TWO LOCATIONS SHOWN ON THIS MAP.

-N-

0 100 200

SCALE: 1" = 200'

Drawn N.M.	5/11/94 Date
Checked [illegible]	5/11/94 Date
Approved EG&G	Date
Approved DOE	Date

SURFACE SOIL AND SEEP SEDIMENT SAMPLES WITH METALS GREATER THAN THE BUTL IHSS 115

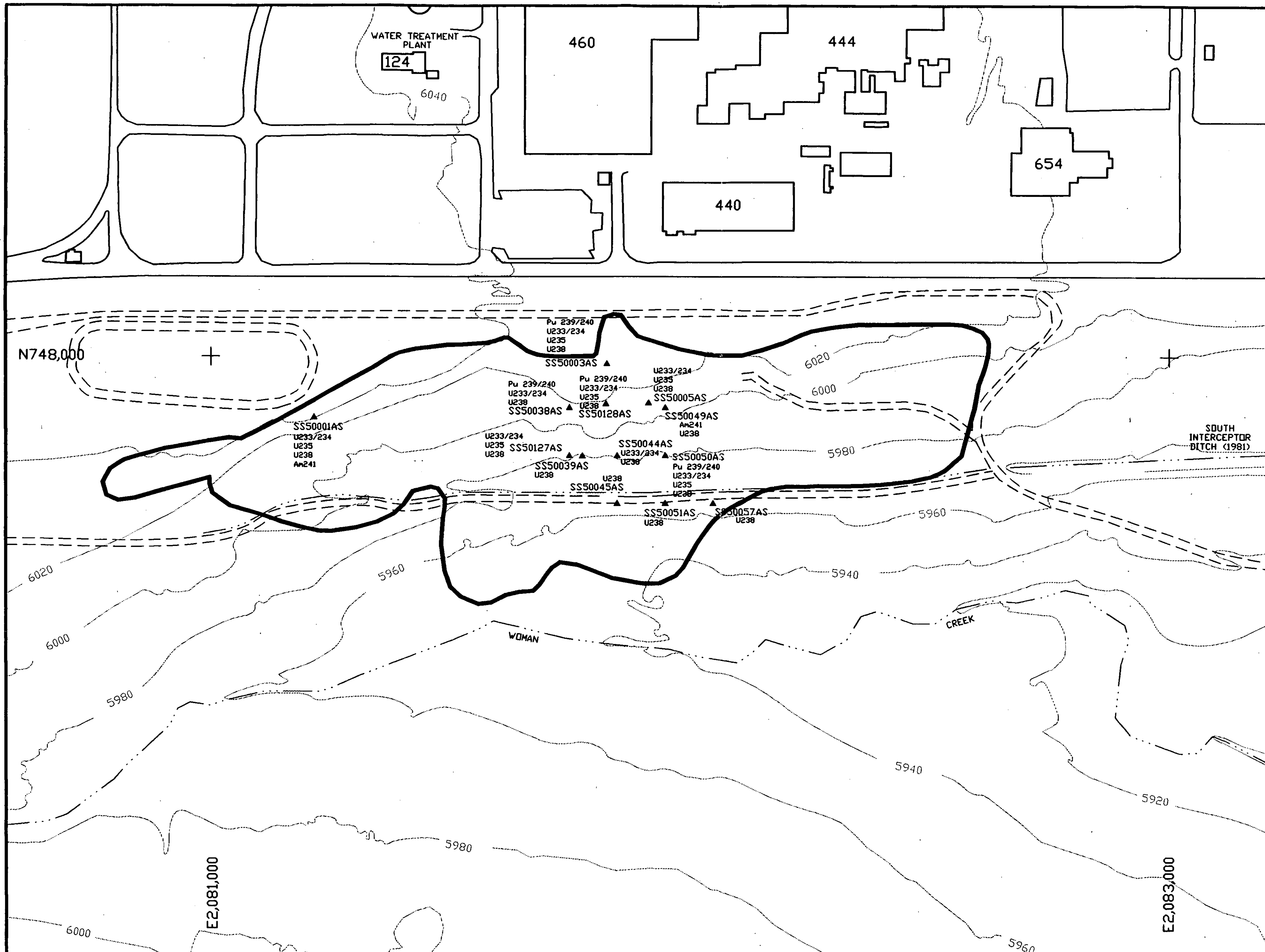
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.4.3.1-2

2431-1.DWG



MAP LEGEND

STREAMS, DITCHES, DRAINAGE FEATURES

PAVED ROADS

DIRT ROADS

LANDFILL BOUNDARY SURFACE DISTURBANCE, PRE - SID

SS50057AS U238 SURFACE SOIL SAMPLE LOCATION WITH ANALYTES ABOVE BUTL

N

0 100 200

SCALE: 1" = 200'

Drawn N.M. 5/11/94 Date

Checked 5/11/94 Date

Approved EG&G Date

Approved DOE Date

SURFACE SOIL SAMPLES WITH RADIONUCLIDES GREATER THAN THE BUTL IHSS 115

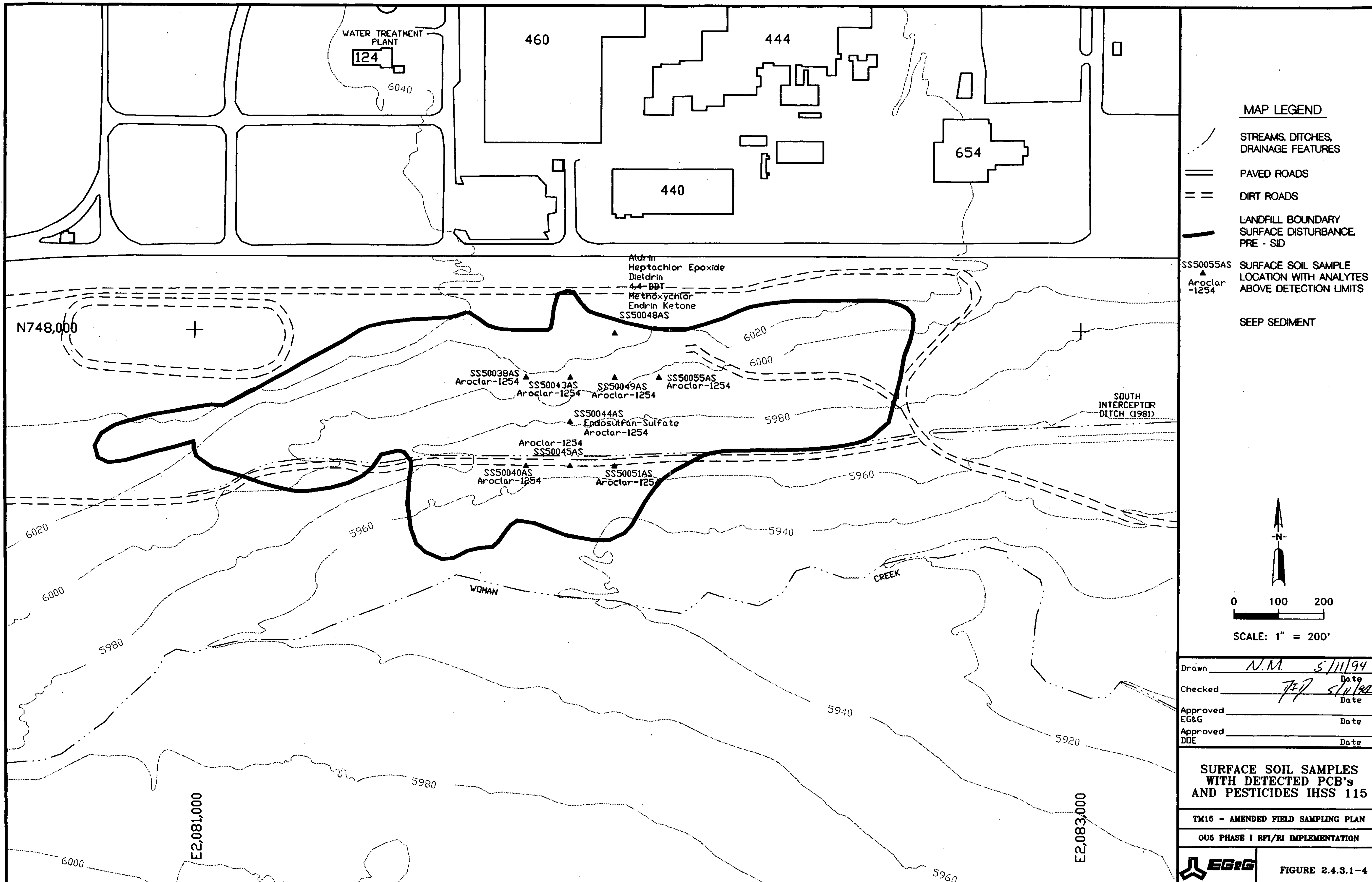
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.4.3.1-3

2431-1.DWG



Drawn	N.M.	5/11/94 Date
Checked	[illegible]	5/11/94 Date
Approved EG&G		Date
Approved DOE		Date

SURFACE SOIL SAMPLES WITH DETECTED PCB's AND PESTICIDES IHSS 115

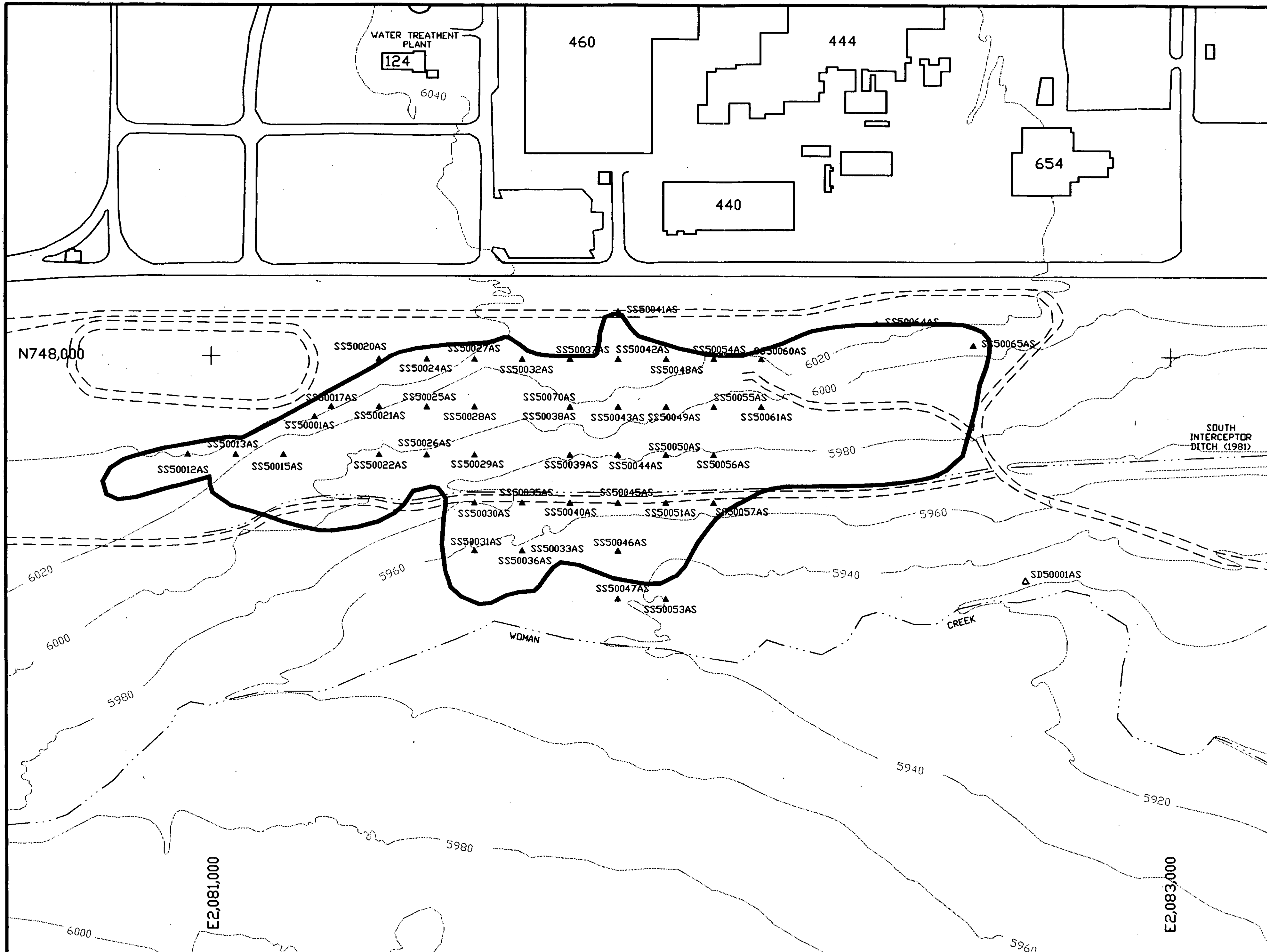
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.4.3.1-4

2431-1.DWG



MAP LEGEND

- STREAMS, DITCHES, DRAINAGE FEATURES
- PAVED ROADS
- DIRT ROADS
- LANDFILL BOUNDARY SURFACE DISTURBANCE, PRE - SID
- SS5000AS — SURFACE SOIL SAMPLE LOCATION WITH DETECTED SEMI-VOLATILE ORGANIC COMPOUNDS
- SD50001AS — SEEP SEDIMENT SAMPLE LOCATION WITH DETECTED SEMI-VOLATILE ORGANIC COMPOUNDS

N

0 100 200

SCALE: 1" = 200'

Drawn	N.M.	5/11/94 Date
Checked	[illegible]	5/11/94 Date
Approved EG&G		Date
Approved DOE		Date

SURFACE SOIL AND SEEP SEDIMENT SAMPLES WITH DETECTED SEMI-VOLATILE ORGANIC COMPOUNDS IHSS 115

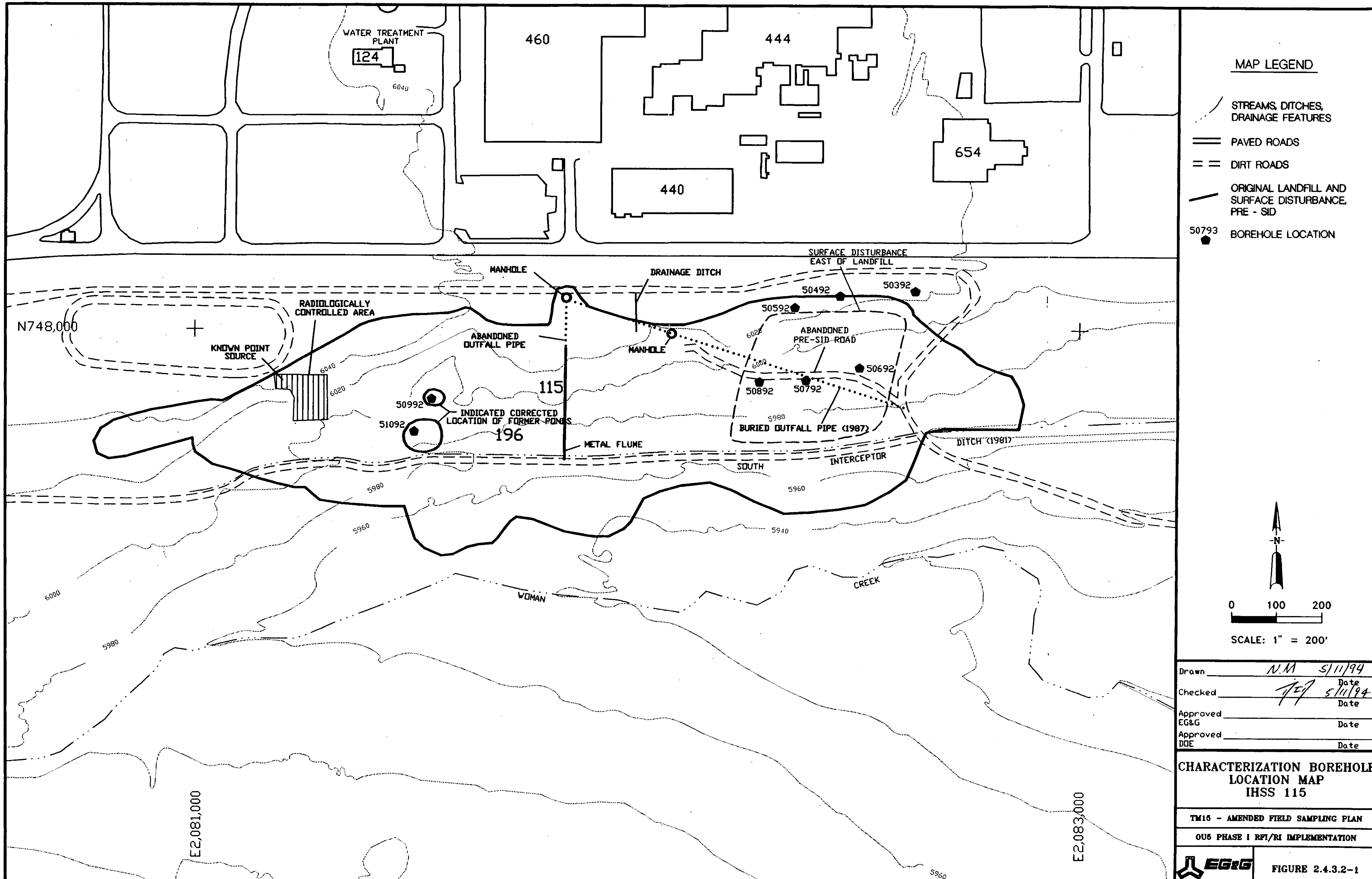
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.4.3.1-5

2431-1.DWG



Drawn N.M	Date 5/11/94
Checked	Date 5/11/94
Approved EG&G	Date
Approved DOE	Date

CHARACTERIZATION BOREHOLE LOCATION MAP IHSS 115

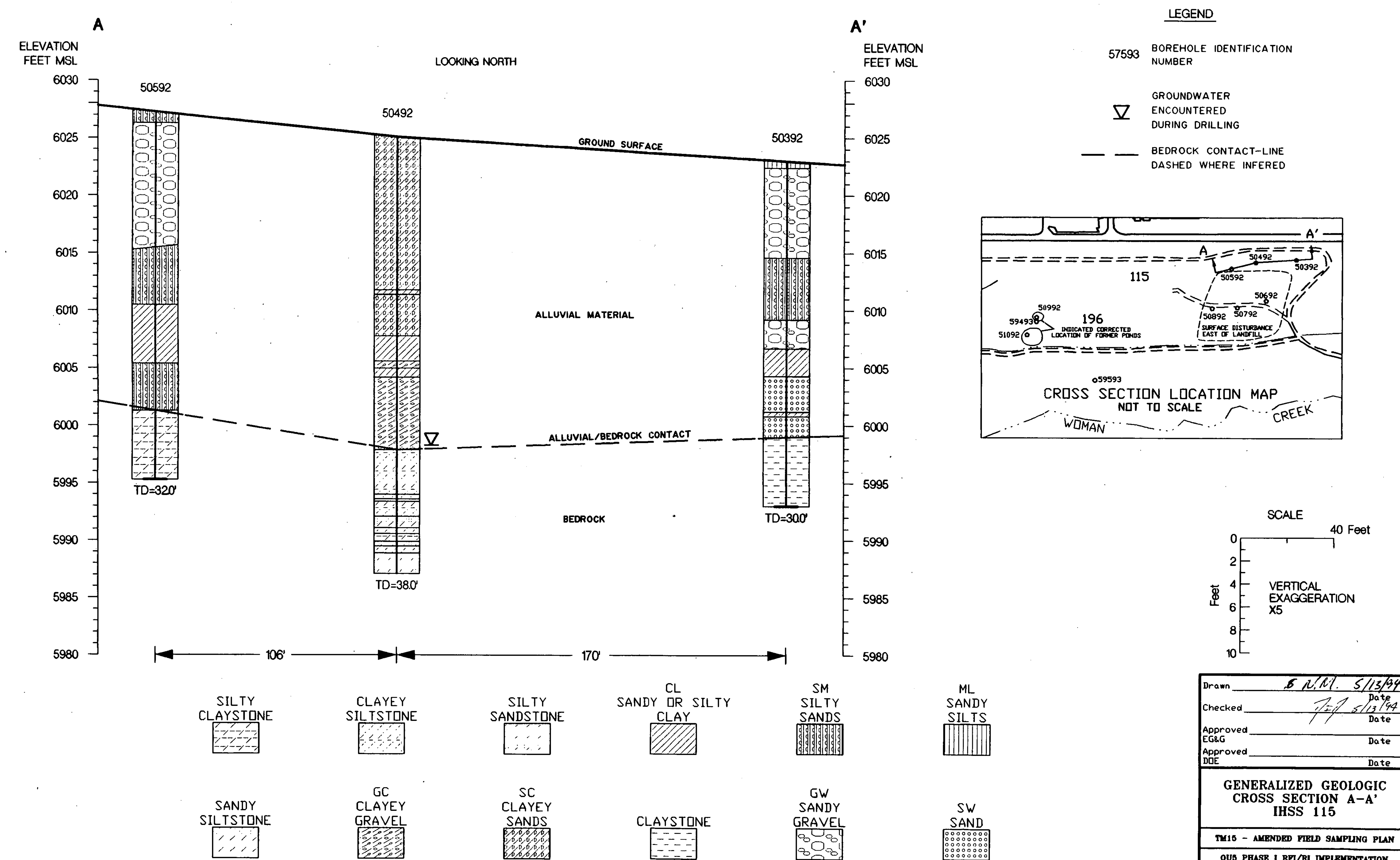
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.4.3.2-1

2432-1.DWG



Drawn B.N.M.	Date 5/13/94
Checked	Date 5/13/94
Approved EG&G	Date
Approved DOE	Date

GENERALIZED GEOLOGIC CROSS SECTION A-A' IHSS 115

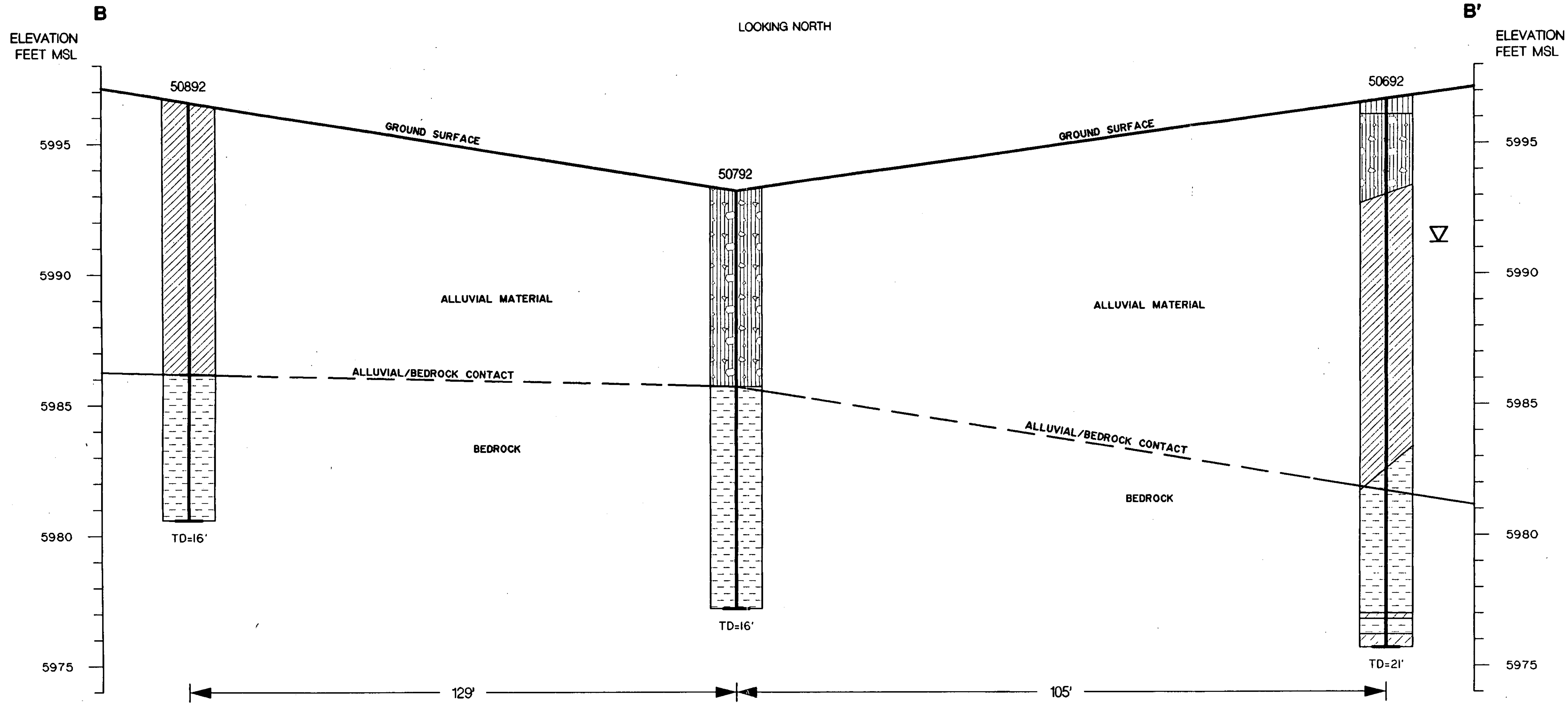
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.4.3.2-2

2432-2.DWG



CLAYSTONE

SILTSTONE

GM SILTY GRAVEL

ML SANDY SILTS

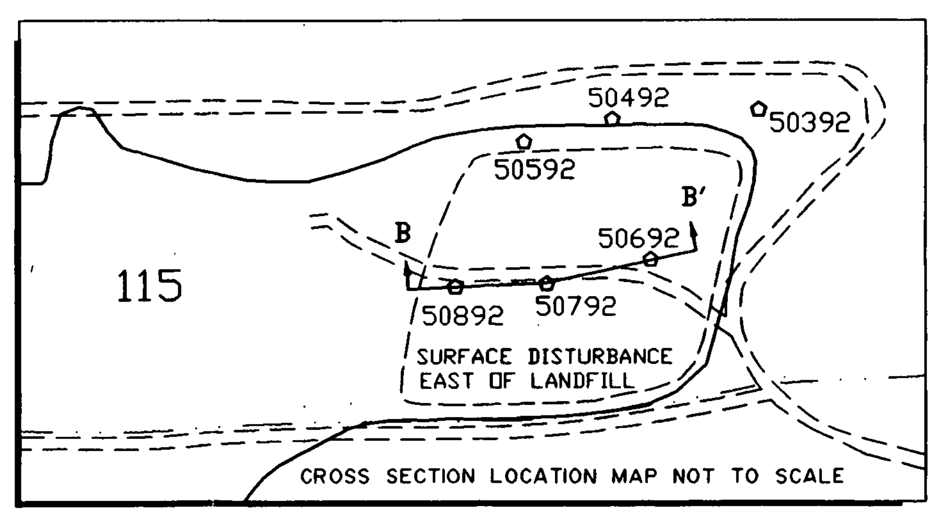
CL CLAY

LEGEND

57593 BOREHOLE IDENTIFICATION NUMBER

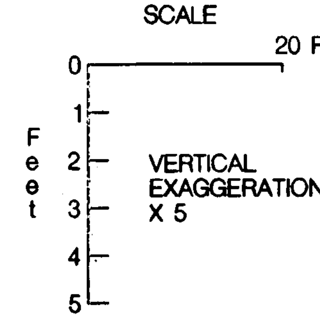
GROUNDWATER ENCOUNTERED DURING DRILLING

BEDROCK CONTACT–LINE DASHED WHERE INFERRED



CROSS SECTION LOCATION MAP NOT TO SCALE

SCALE



Drawn N.M.	5/13/94 Date
Checked [illegible]	5/13/94 Date
Approved EG&G	Date
Approved DOE	Date

GENERALIZED GEOLOGIC CROSS SECTION B–B' IHSS 115

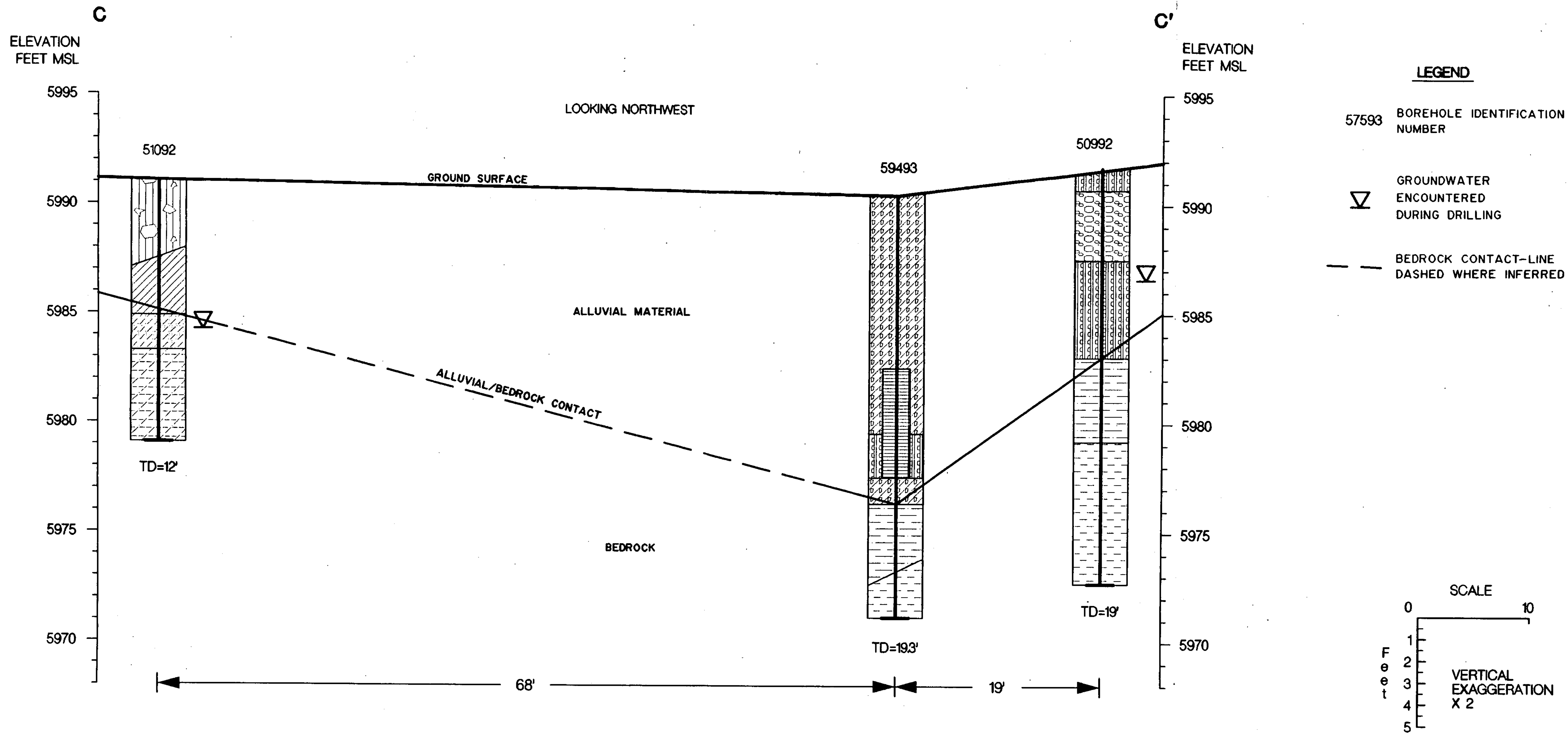
TM15 – AMENDED FIELD SAMPLING PLAN

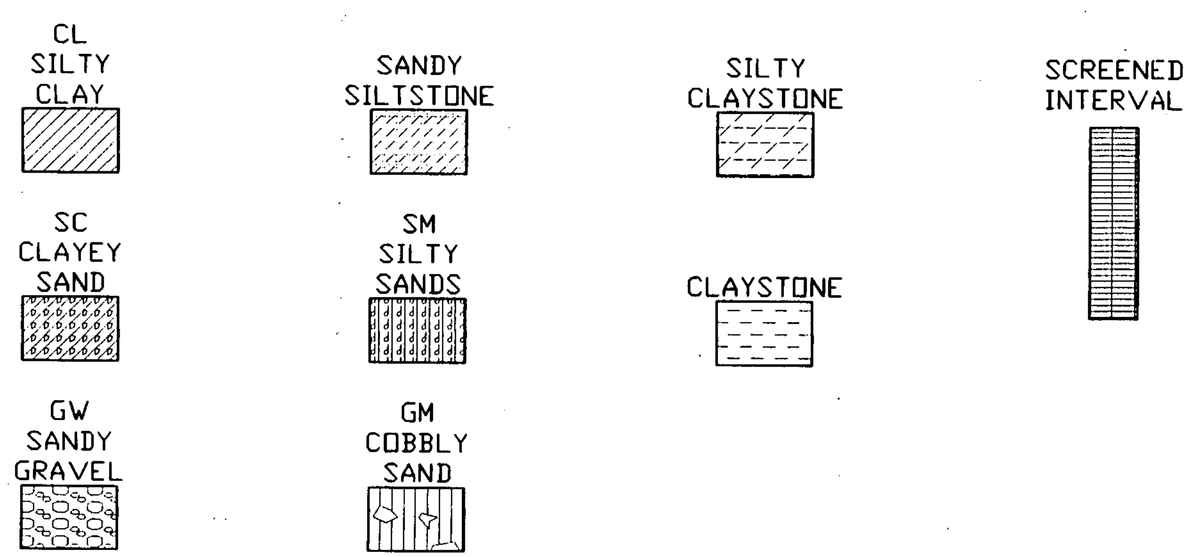
OU5 PHASE I RFI/RI IMPLEMENTATION

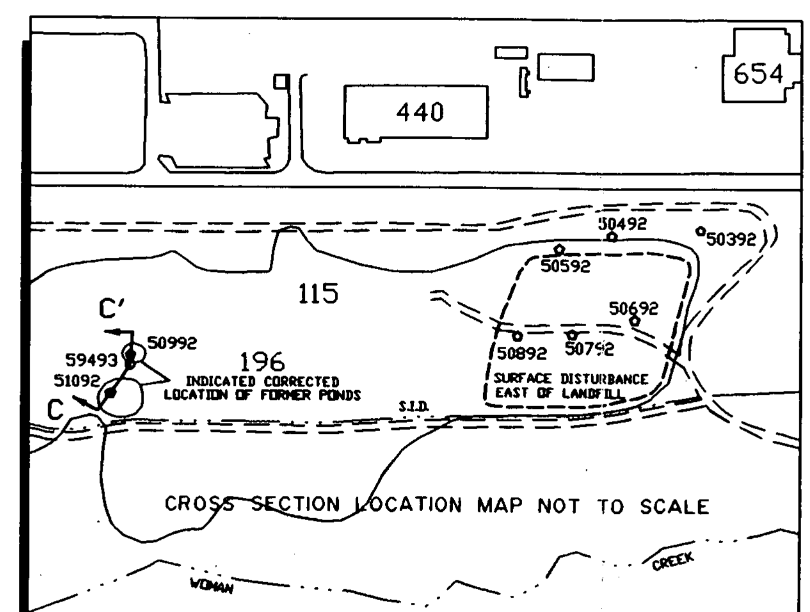
EG&G

FIGURE 2.4.3.2–3

2432-3DWG







Drawn NM	5/13/94 Date
Checked	5/13/94 Date
Approved EG&G	Date
Approved DOE	Date

GENERALIZED GEOLOGIC CROSS SECTION C-C' IHSS 196

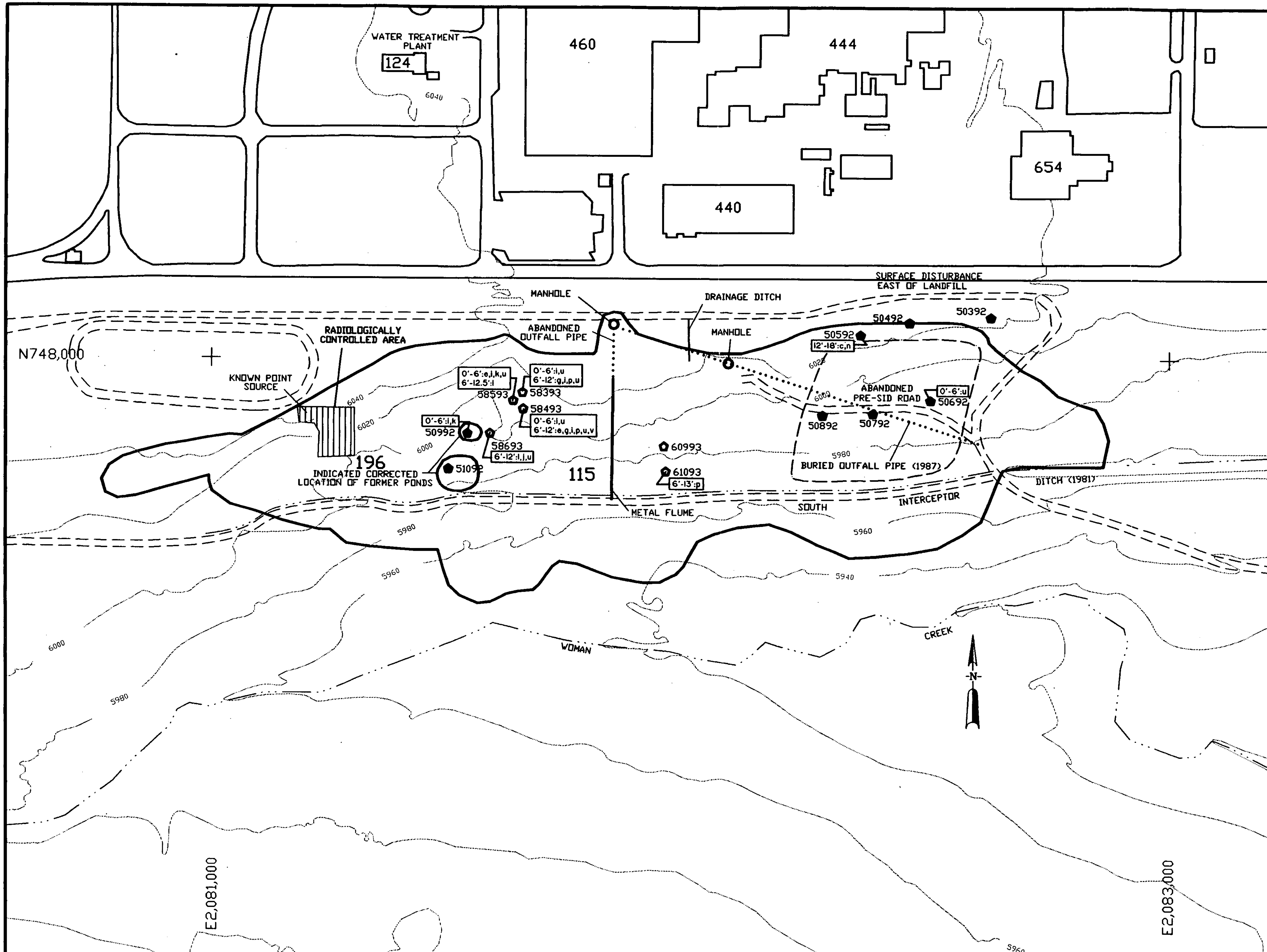
TM16 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.4.3.2-4

2432-4DWG



MAP LEGEND

STREAMS, DITCHES, DRAINAGE FEATURES

PAVED ROADS

DIRT ROADS

ORIGINAL LANDFILL AND SURFACE DISTURBANCE, PRE - SID

59293 CHARACTERIZATION BOREHOLE LOCATION (SECTION 2.4.3.2)

58493 SOIL GAS BOREHOLE LOCATION (SECTION 2.4.3.3)

CONSTITUENTS (INDICATED WITH SAMPLE DEPTH)

a = ALUMINUM
b = ARSENIC
c = BARIUM
d = BERYLLIUM
e = CADMIUM
f = CALCIUM
g = CHROMIUM
h = COBALT
i = COPPER
j = IRON
k = LEAD
l = LITHIUM
m = MAGNESIUM
n = MANGANESE
o = MERCURY
p = NICKEL
q = POTASSIUM
r = SILICON
s = STRONTIUM
t = VANADIUM
u = ZINC
v = MOLYBDENUM

0 100 200

SCALE: 1" = 200'

Drawn N.M.	5/11/94 Date
Checked TJ	5/11/94 Date
Approved EG&G	Date
Approved DOE	Date

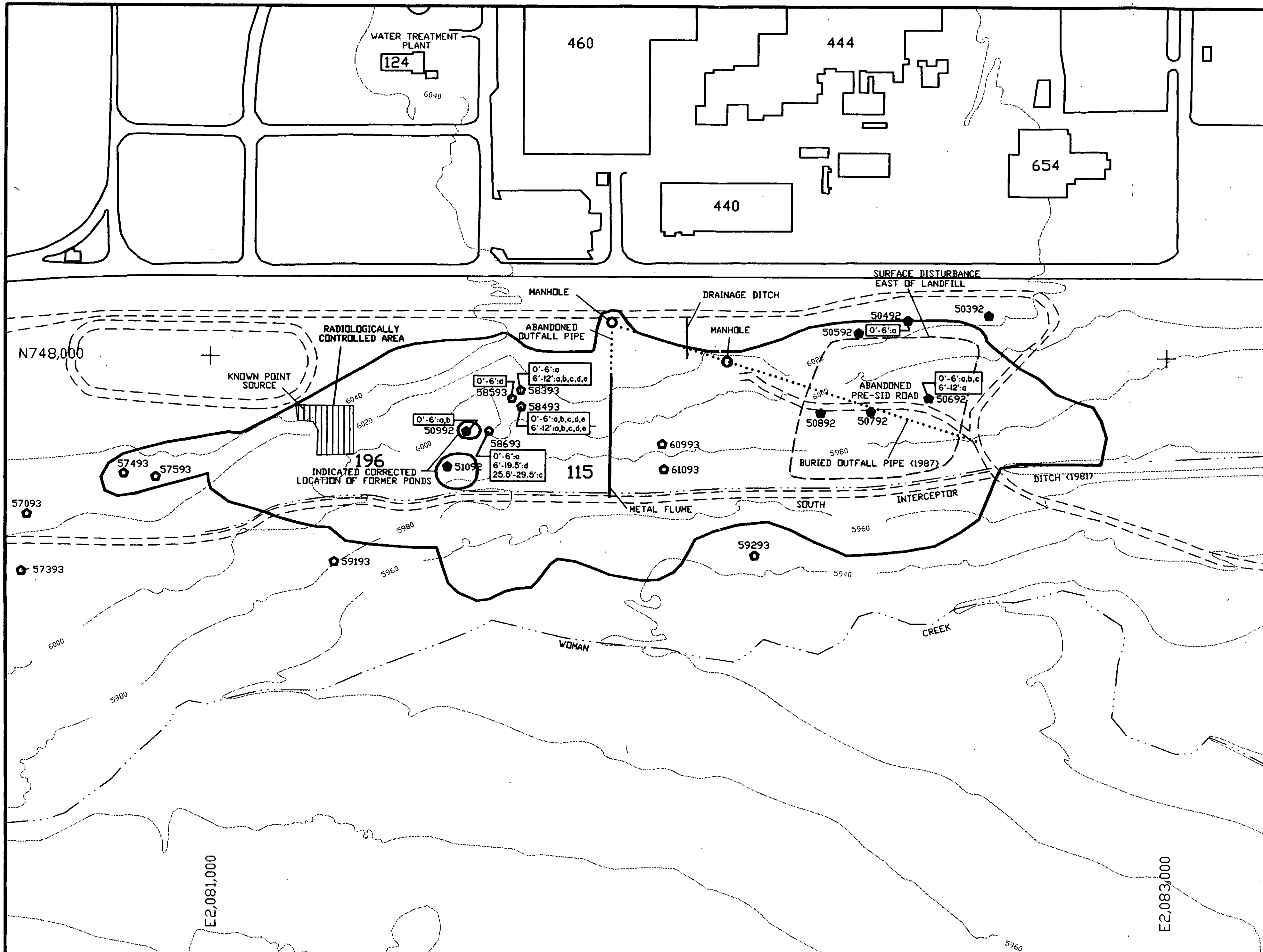
METALS DETECTED EXCEEDING BUTLS IN BOREHOLE SOIL SAMPLES IHSS 115/196

TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G FIGURE 2.4.3.2-5

2432-5.DWG



MAP LEGEND

STREAMS, DITCHES, DRAINAGE FEATURES

PAVED ROADS

DIRT ROADS

ORIGINAL LANDFILL AND SURFACE DISTURBANCE, PRE - SID

59293 CHARACTERIZATION BOREHOLE LOCATION (SECTION 2.4.3.2)

58793 SOIL GAS BOREHOLE LOCATION (SECTION 2.4.3.3)

CONSTITUENTS (INDICATED WITH SAMPLE DEPTH)

a = PLUTONIUM - 239/240
b = AMERICIUM - 241
c = URANIUM - 238
d = URANIUM - 235
e = URANIUM - 233, 234

-N-

0 100 200

SCALE: 1" = 200'

Drawn	NM 5/11/94 Date
Checked	5/11/94 Date
Approved EG&G	Date
Approved DOE	Date

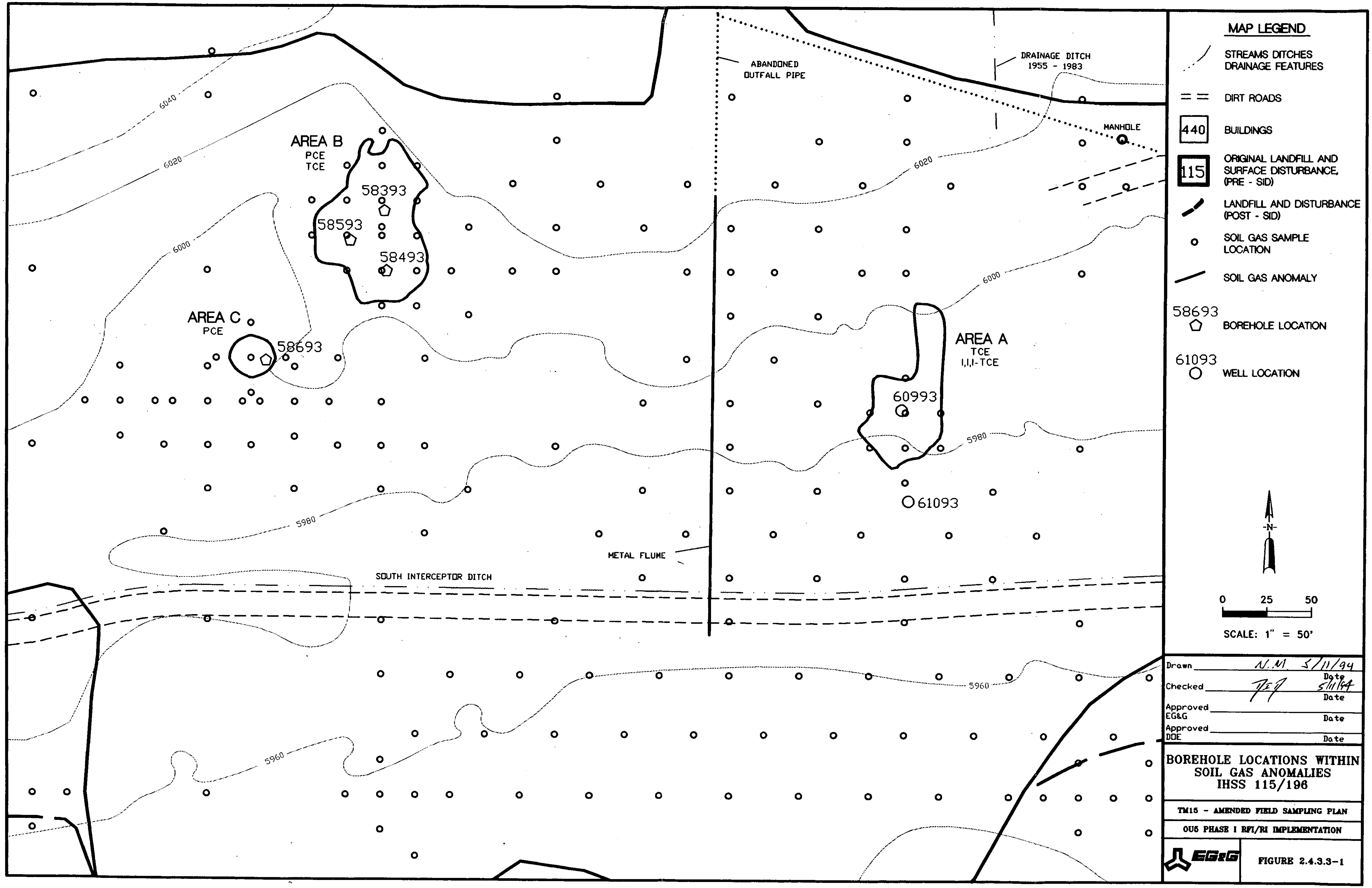
RADIONUCLIDES DETECTED EXCEEDING BUTLS IN BOREHOLE SOIL SAMPLES IHSS 115/196

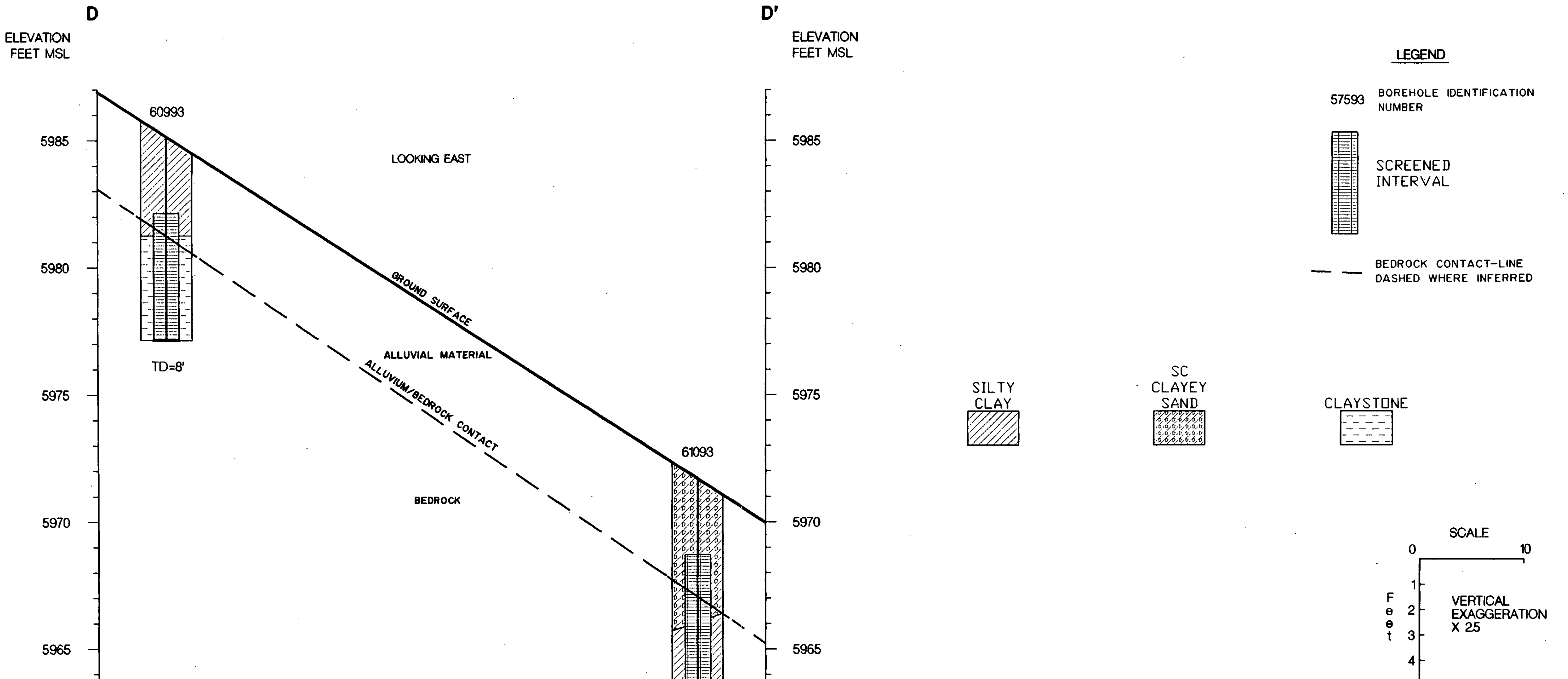
TM15 - AMENDED FIELD SAMPLING PLAN

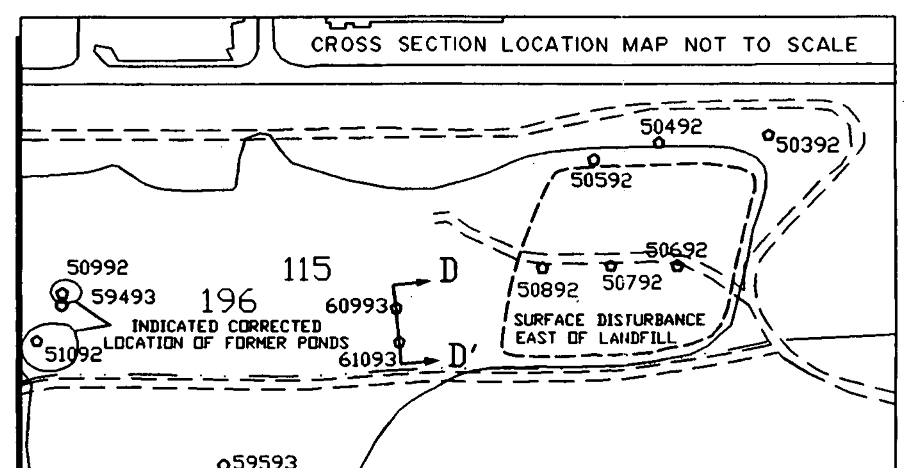
OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G FIGURE 2.4.3.2-6

2432-6.DWG


AREA B
PCE
TCE
58393
58593
58493
AREA C
PCE
58693
AREA A
TCE
1,1,1-TCE
60993
61093
6040
6020
6000
5980
5960
ABANDONED OUTFALL PIPE
DRAINAGE DITCH 1955 - 1983
MANHOLE
METAL FLUME
SOUTH INTERCEPTOR DITCH
MAP LEGEND
STREAMS DITCHES DRAINAGE FEATURES
DIRT ROADS
440
BUILDINGS
115
ORIGINAL LANDFILL AND SURFACE DISTURBANCE, (PRE - SID)
LANDFILL AND DISTURBANCE (POST - SID)
SOIL GAS SAMPLE LOCATION
SOIL GAS ANOMALY
58693
BOREHOLE LOCATION
61093
WELL LOCATION
N
0
25
50
SCALE: 1" = 50'
Drawn N.M. 5/11/94
Date
Checked 5/11/94
Date
Approved EG&G
Date
Approved DOE
Date
BOREHOLE LOCATIONS WITHIN SOIL GAS ANOMALIES IHSS 115/196
TM15 - AMENDED FIELD SAMPLING PLAN
OU5 PHASE I RFI/RI IMPLEMENTATION
EG&G
FIGURE 2.4.3.3-1





Drawn N.M.	5/13/94 Date
Checked [illegible]	5/13/94 Date
Approved EG&G	Date
Approved DOE	Date

GENERALIZED GEOLOGIC CROSS SECTION D-D' SOIL-GAS ANOMALY WELLS IHSS 115

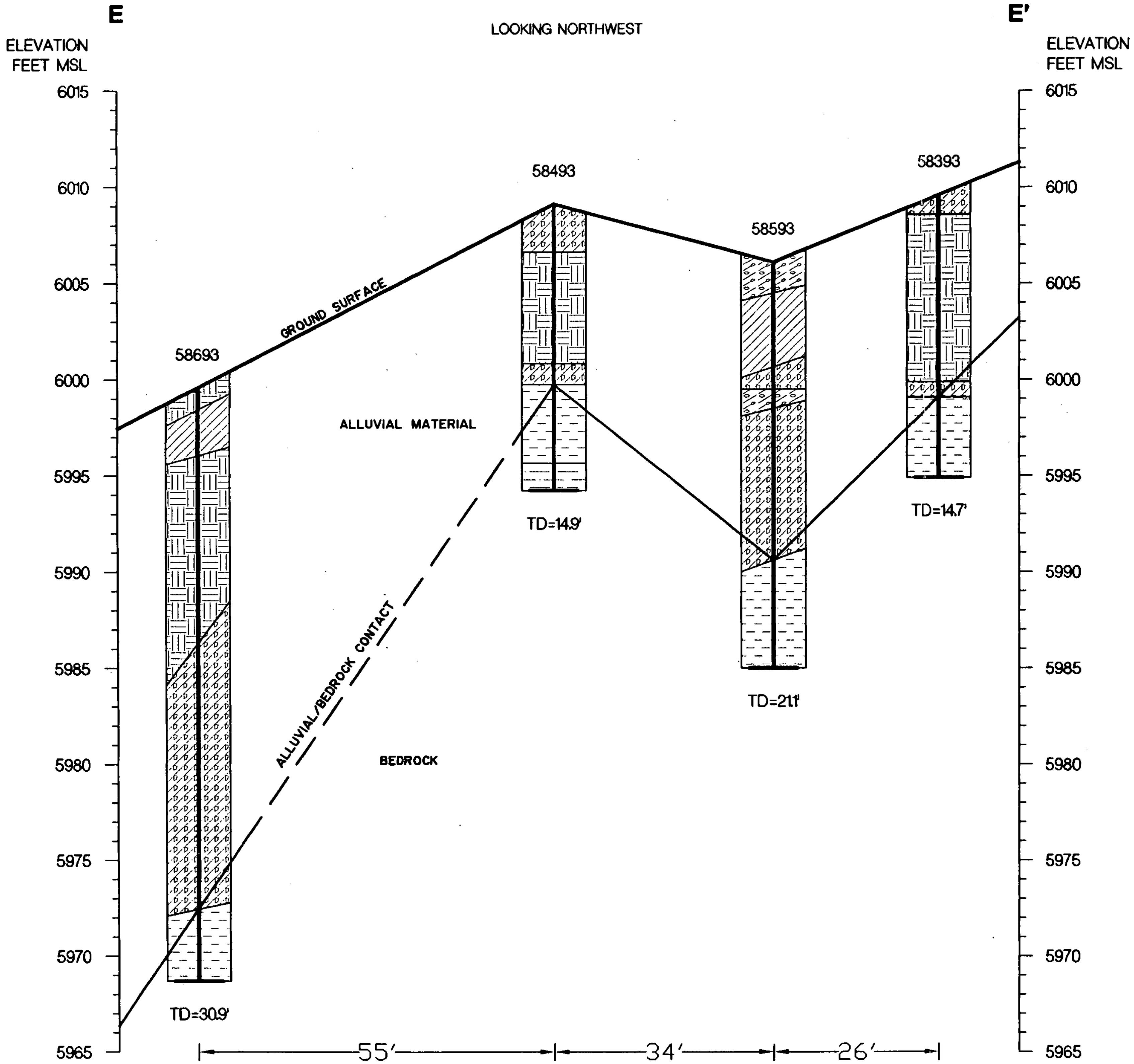
TM15 - AMENDED FIELD SAMPLING PLAN

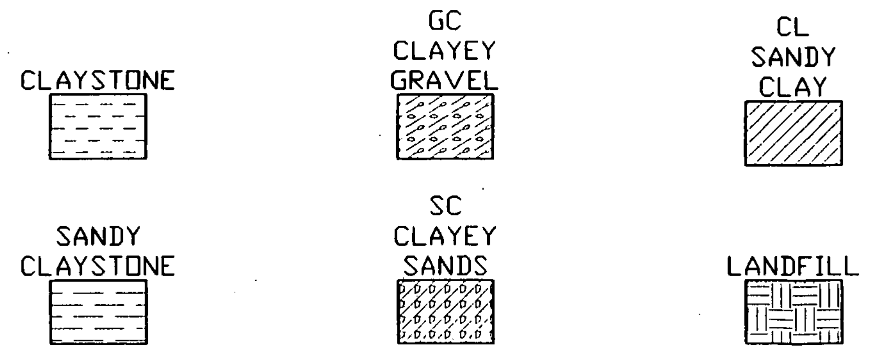
OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.4.3.3-2

2433-2DWG

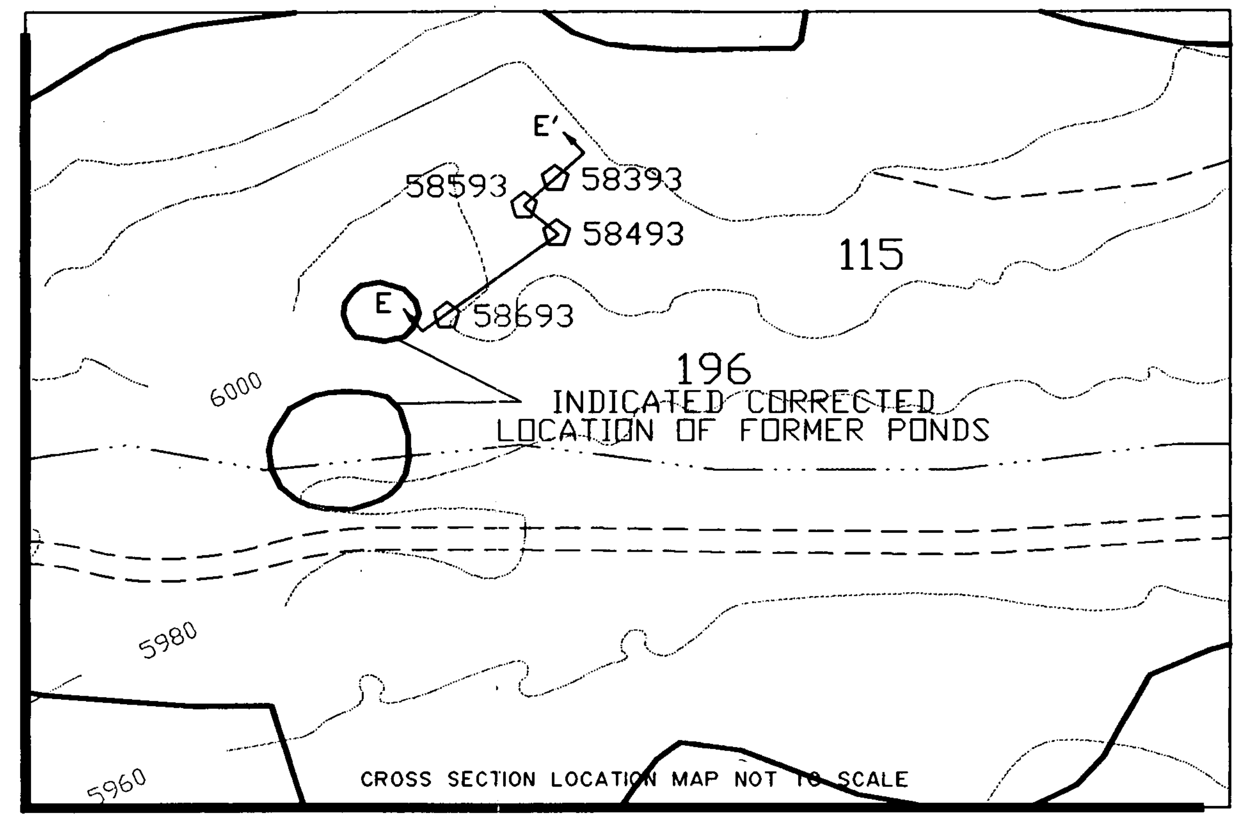


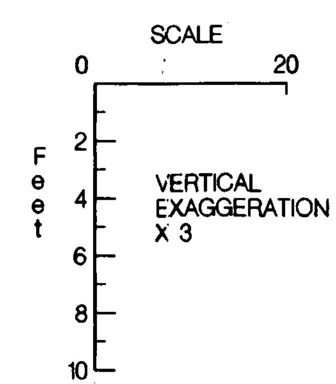


LEGEND

57593 BOREHOLE IDENTIFICATION NUMBER

BEDROCK CONTACT-LINE DASHED WHERE INFERRED





Drawn N.M.	Date 5/13/94
Checked	Date 5/13/94
Approved EG&G	Date
Approved DOE	Date

GENERALIZED GEOLOGIC CROSS SECTION E-E' SOIL GAS ANOMALY BORINGS IHSS 115

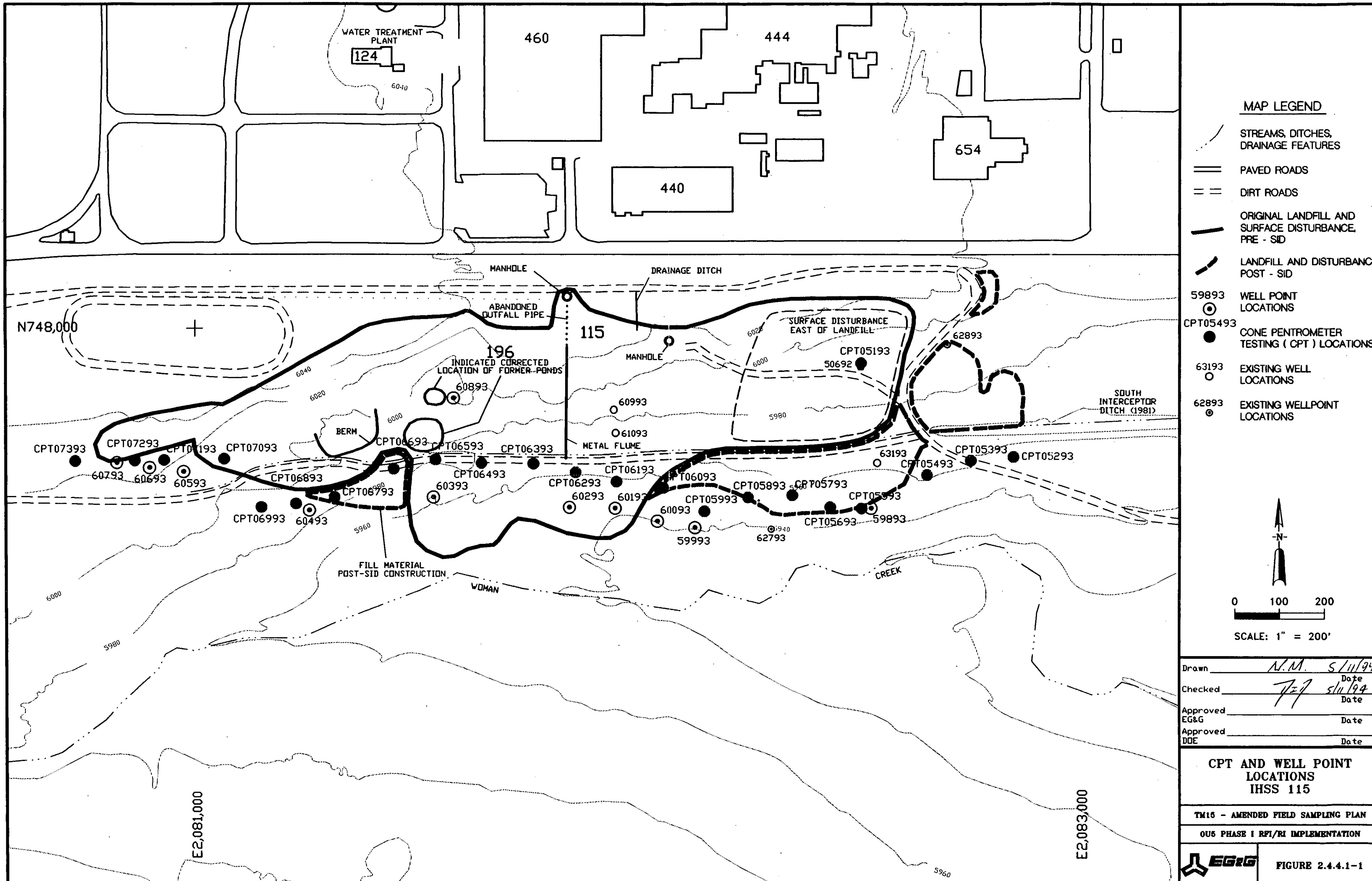
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.4.3.3-3

2433-3DWG



Drawn N.M. 5/11/94 Date

Checked 5/11/94 Date

Approved EG&G Date

Approved DOE Date

CPT AND WELL POINT LOCATIONS IHSS 115

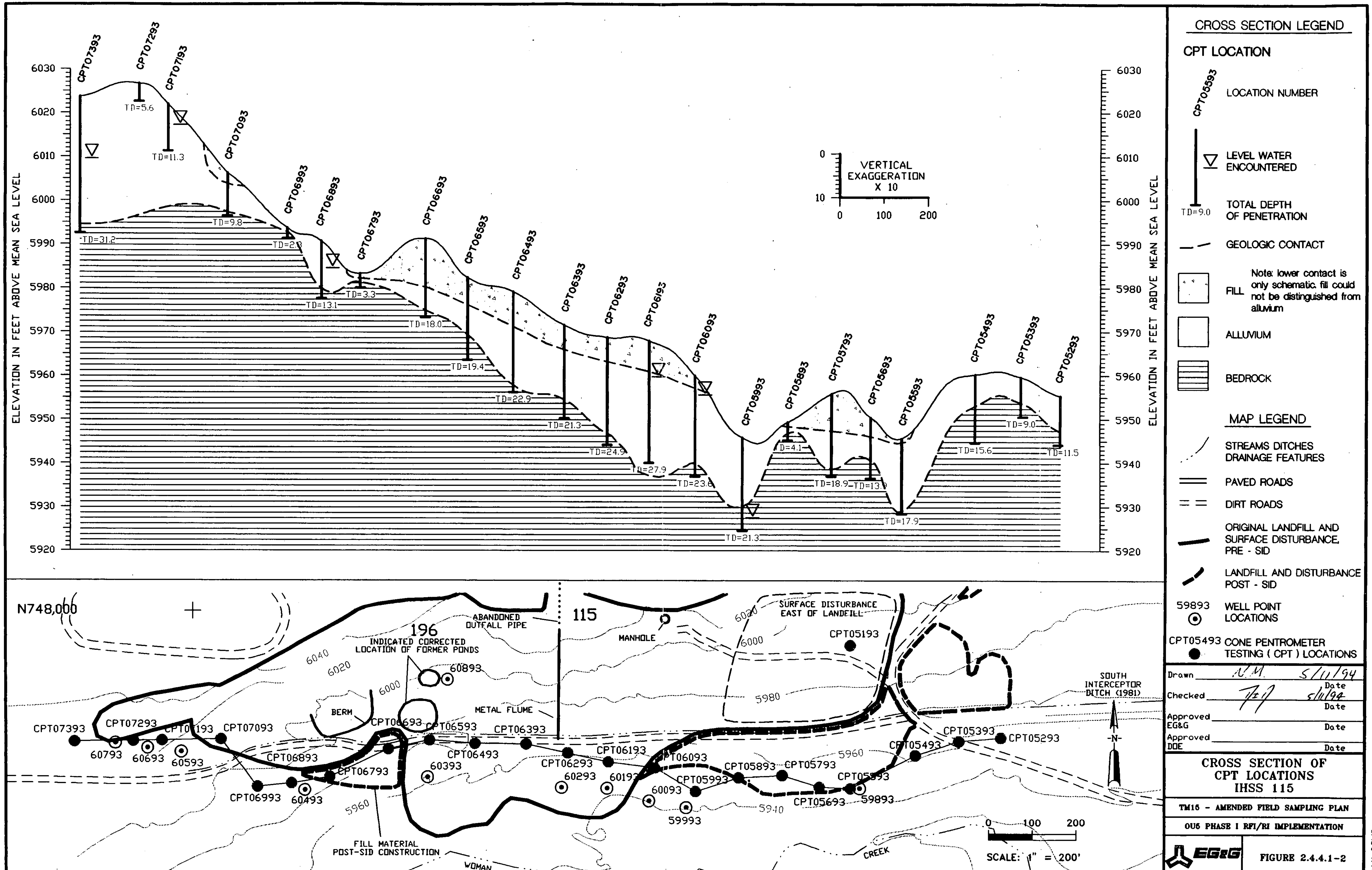
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

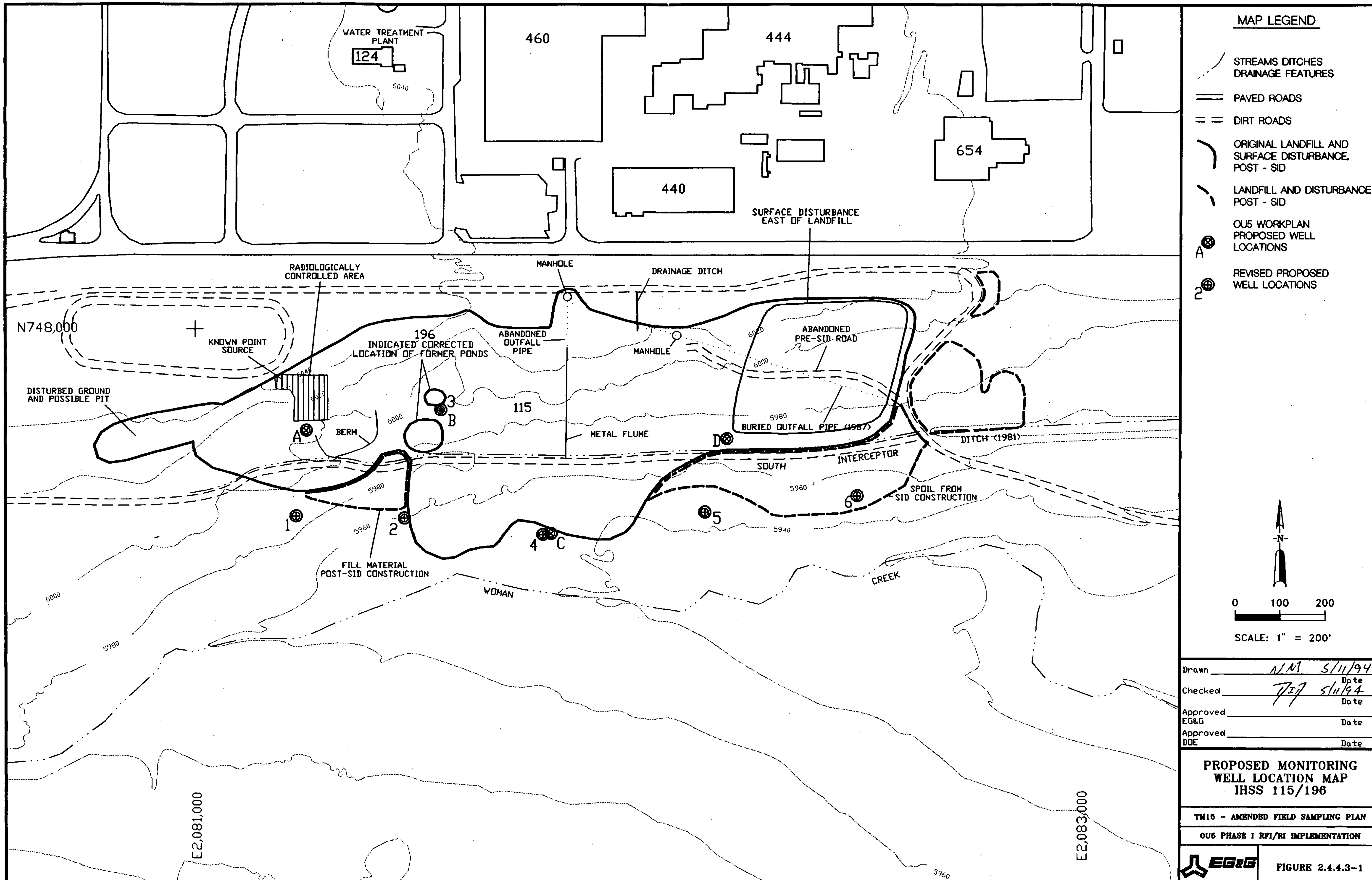
EG&G

FIGURE 2.4.4.1-1

2441-1.DWG



ELEVATION IN FEET ABOVE MEAN SEA LEVEL
6030
6020
6010
6000
5990
5980
5970
5960
5950
5940
5930
5920
CPT07393
CPT07293
CPT07193
CPT07093
CPT06993
CPT06893
CPT06793
CPT06693
CPT06593
CPT06493
CPT06393
CPT06293
CPT06193
CPT06093
CPT05993
CPT05893
CPT05793
CPT05693
CPT05593
CPT05493
CPT05393
CPT05293
TD=31.2
TD=5.6
TD=11.3
TD=9.8
TD=2.8
TD=13.1
TD=3.3
TD=18.0
TD=19.4
TD=22.9
TD=21.3
TD=24.9
TD=27.9
TD=23.6
TD=21.3
TD=4.1
TD=18.9
TD=13.9
TD=17.9
TD=15.6
TD=9.0
TD=11.5
VERTICAL EXAGGERATION X 10
0
10
0
100
200
CROSS SECTION LEGEND
CPT LOCATION
CPT05593
LOCATION NUMBER
LEVEL WATER ENCOUNTERED
TD=9.0
TOTAL DEPTH OF PENETRATION
GEOLOGIC CONTACT
FILL
Note: lower contact is only schematic. fill could not be distinguished from alluvium
ALLUVIUM
BEDROCK
MAP LEGEND
STREAMS DITCHES DRAINAGE FEATURES
PAVED ROADS
DIRT ROADS
ORIGINAL LANDFILL AND SURFACE DISTURBANCE, PRE - SID
LANDFILL AND DISTURBANCE POST - SID
59893
WELL POINT LOCATIONS
CPT05493
CONE PENETROMETER TESTING (CPT) LOCATIONS
N748,000
196
115
ABANDONED OUTFALL PIPE
INDICATED CORRECTED LOCATION OF FORMER PONDS
MANHOLE
SURFACE DISTURBANCE EAST OF LANDFILL
BERM
METAL FLUME
SOUTH INTERCEPTOR DITCH (1981)
FILL MATERIAL POST-SID CONSTRUCTION
WOMAN
CREEK
6040
6020
6000
5980
5960
5940
60893
60793
60693
60593
60493
60393
60293
60193
60093
59993
59893
CPT05193
-N-
0
100
200
SCALE: 1" = 200'
Drawn N.M. 5/11/94
Checked 5/11/94
Date
Approved EG&G
Date
Approved DOE
Date
CROSS SECTION OF CPT LOCATIONS IHSS 115
TM16 - AMENDED FIELD SAMPLING PLAN
OU5 PHASE I RFI/RI IMPLEMENTATION
EG&G
FIGURE 2.4.4.1-2
2441-2.DWG



Drawn NM 5/11/94 Date

Checked 5/11/94 Date

Approved EG&G Date

Approved DOE Date

PROPOSED MONITORING WELL LOCATION MAP IHSS 115/196

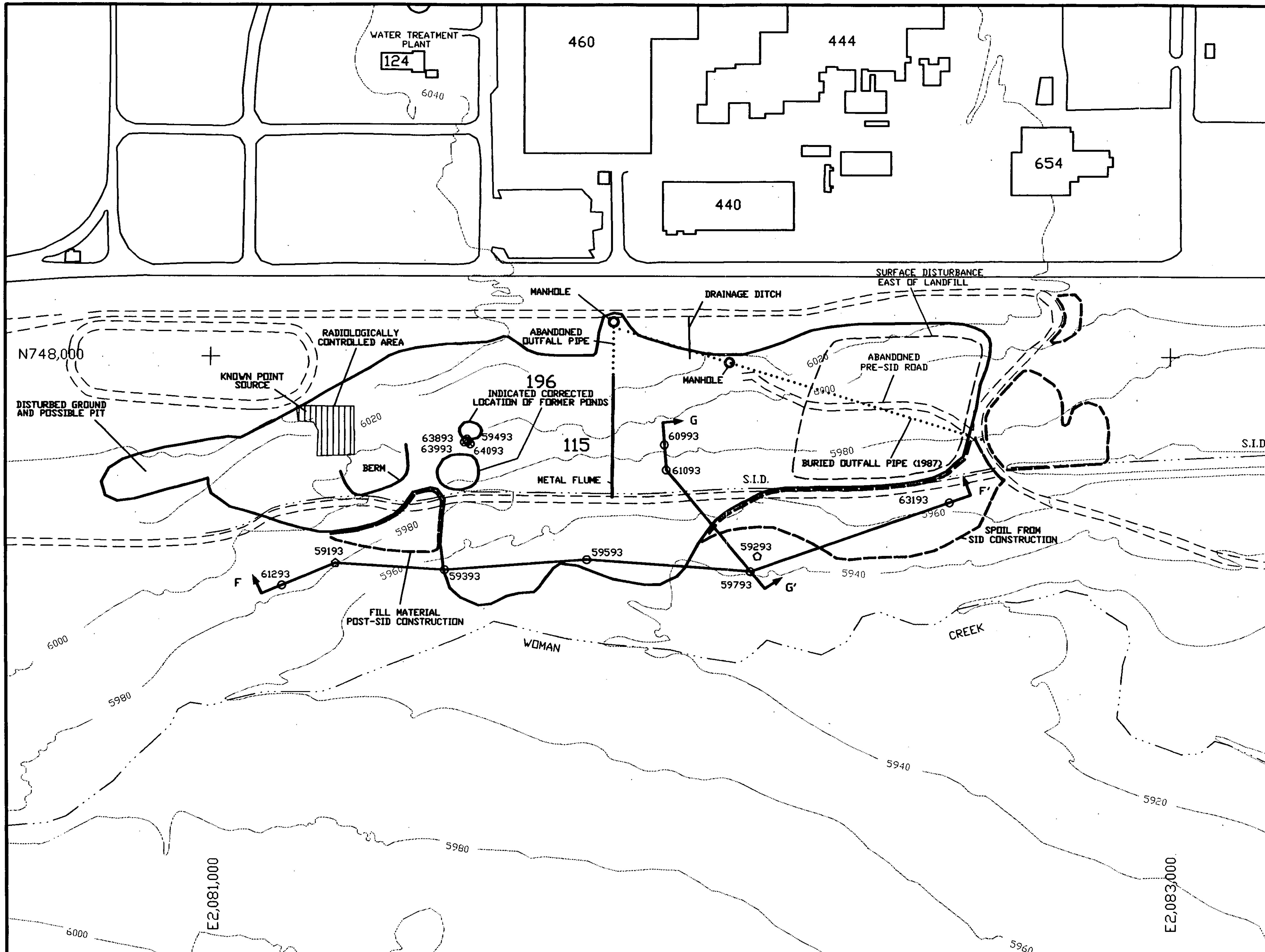
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.4.4.3-1

2443-1.DWG



MAP LEGEND

STREAMS DITCHES DRAINAGE FEATURES

PAVED ROADS

DIRT ROADS

ORIGINAL LANDFILL AND SURFACE DISTURBANCE, PRE - SID

LANDFILL AND DISTURBANCE POST - SID

61293 WELL LOCATIONS

59293 BOREHOLE LOCATION

63993 WELL POINT LOCATIONS

F F' CROSS SECTION LOCATION

-N-

0 100 200

SCALE: 1" = 200'

Drawn N.M. 5/11/94
Date

Checked [illegible] 5/11/94
Date

Approved EG&G
Date

Approved DOE
Date

MONITORING WELL LOCATION MAP IHSS 115/196

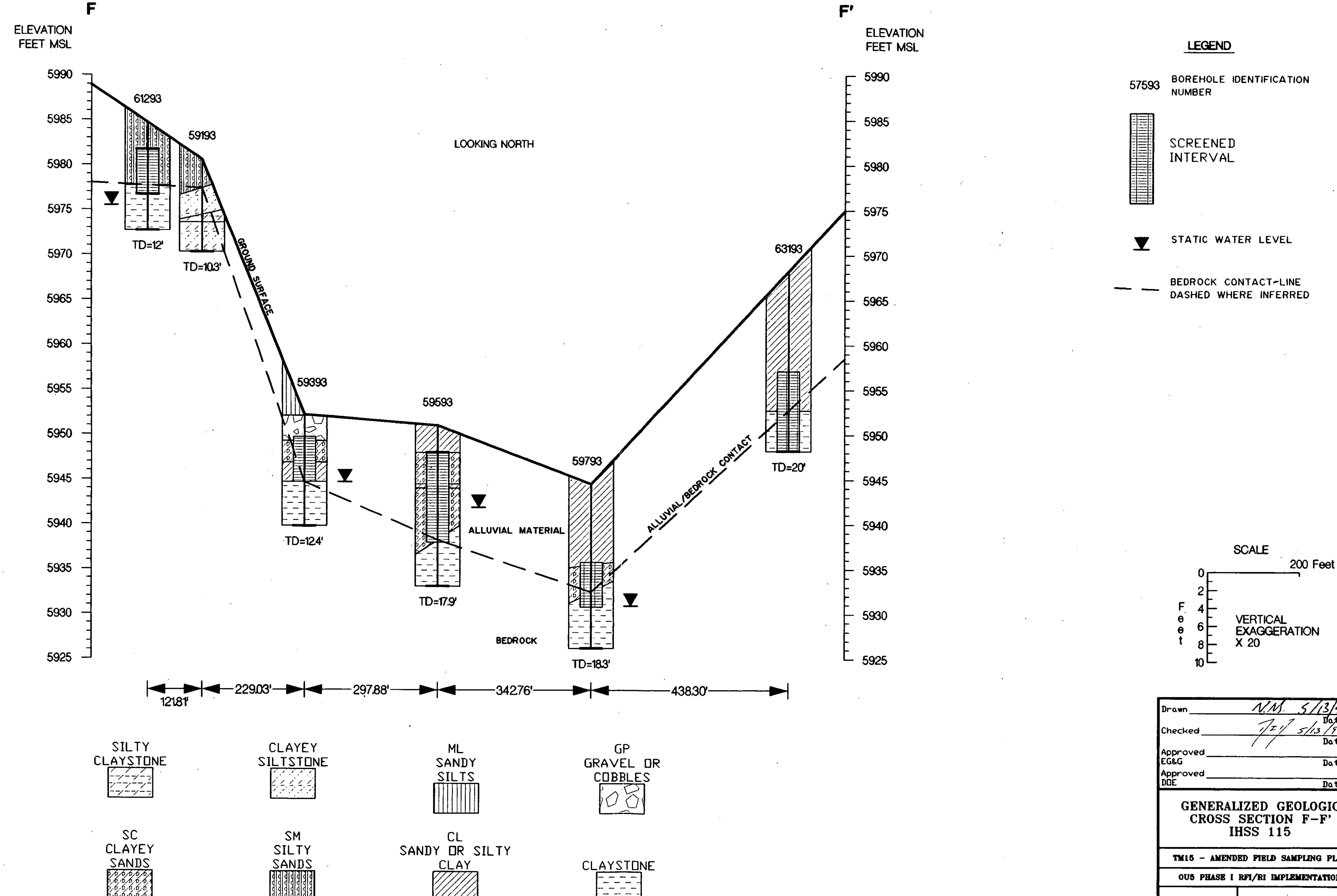
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.4.4.3-2

2443-2.DWG



NOTE: SEE FIGURE 2.4.4.3-2 FOR CROSS SECTION LOCATION

Drawn	N.M.	5/13/94 Date
Checked	[illegible]	5/13/94 Date
Approved EG&G		Date
Approved DOE		Date

GENERALIZED GEOLOGIC CROSS SECTION F-F' IHSS 115

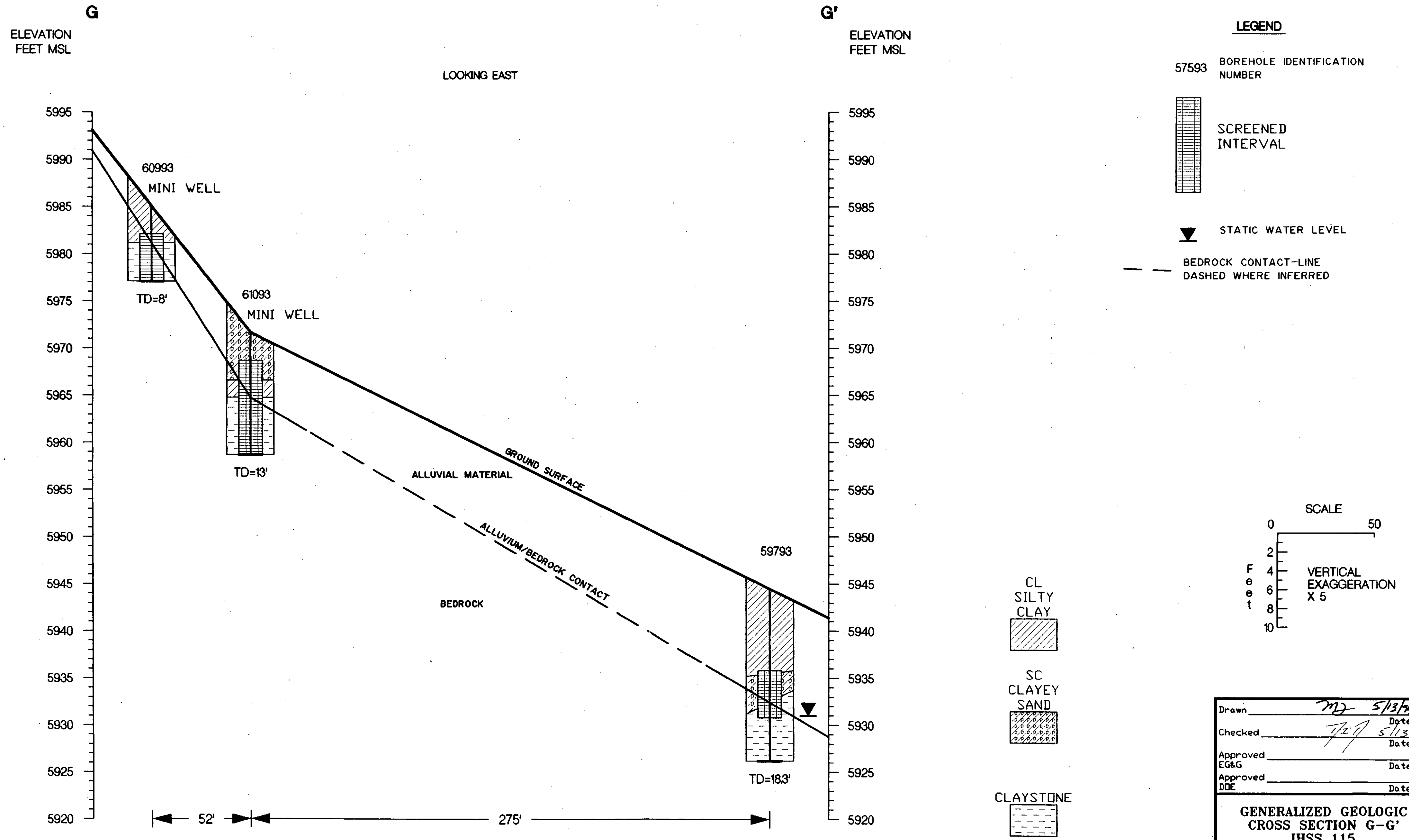
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.4.4.3-3

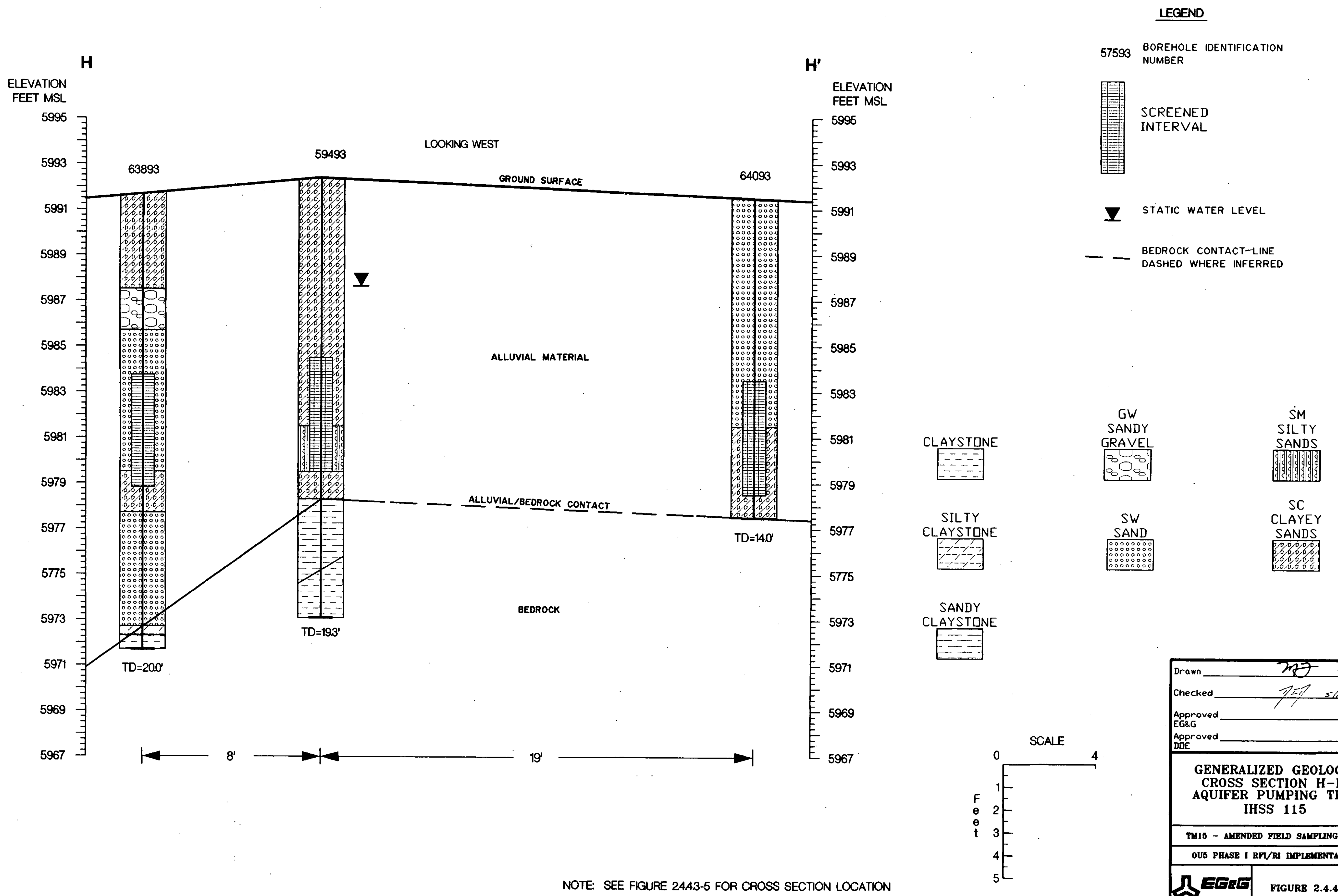
2443-3DWG



NOTE: SEE FIGURE 2.4.4.3-2 FOR CROSS SECTION LOCATION

Drawn MJ 5/13/94 Date	
Checked TJ 5/13/94 Date	
Approved EG&G Date	
Approved DOE Date	
GENERALIZED GEOLOGIC CROSS SECTION G-G' IHSS 115	
TM15 - AMENDED FIELD SAMPLING PLAN	
OU5 PHASE I RFI/RI IMPLEMENTATION	
EG&G	FIGURE 2.4.4.3-4

2443-4DWG



NOTE: SEE FIGURE 2.4.4.3-5 FOR CROSS SECTION LOCATION

Drawn	5/13/94 Date
Checked	5/13/94 Date
Approved EG&G	Date
Approved DOE	Date

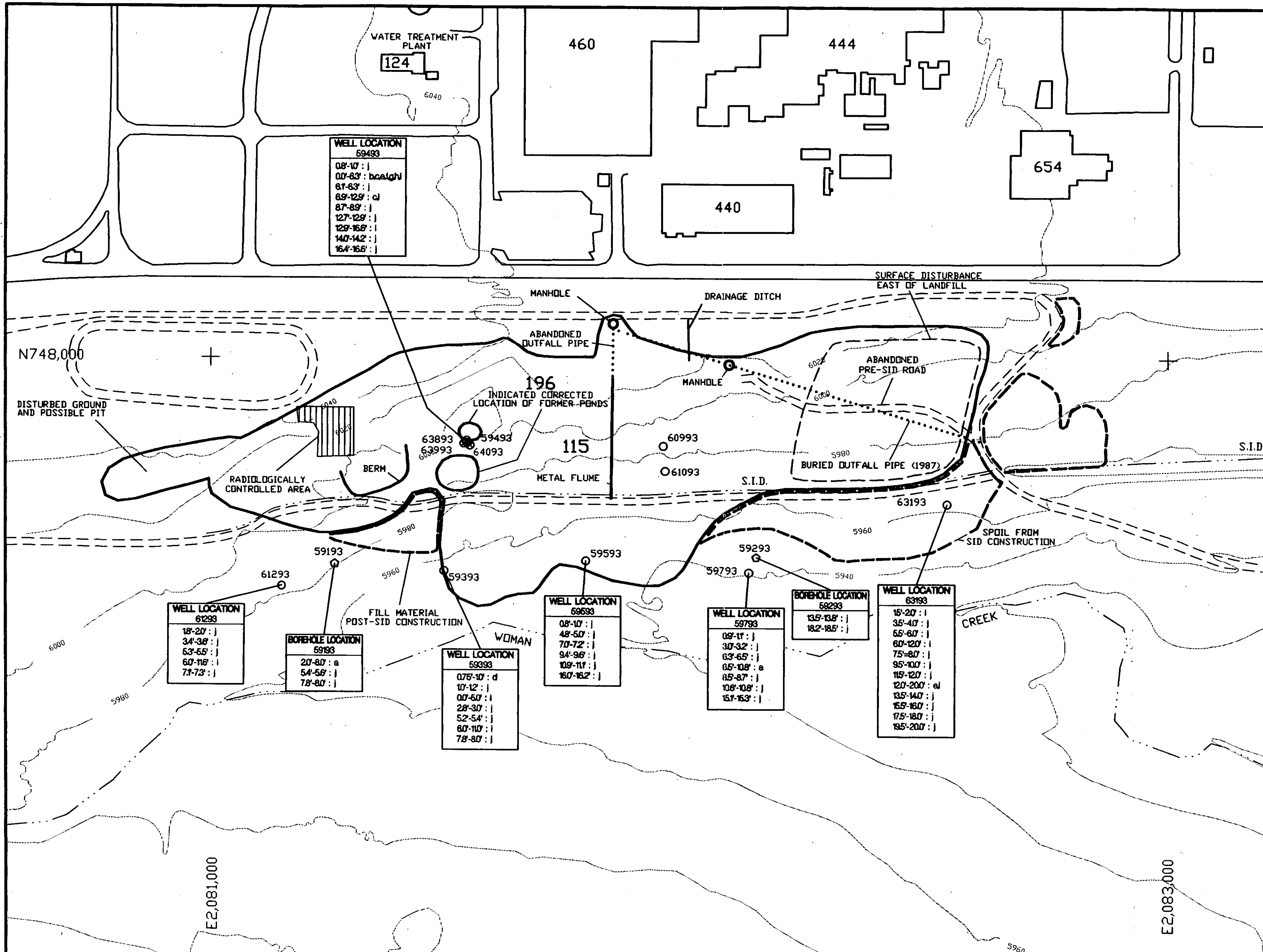
GENERALIZED GEOLOGIC CROSS SECTION H-H' AQUIFER PUMPING TEST IHSS 115

TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.4.4.3-6



MAP LEGEND

- STREAMS, DITCHES, DRAINAGE FEATURES
- PAVED ROADS
- DIRT ROADS
- ORIGINAL LANDFILL AND SURFACE DISTURBANCE, PRE - SID
- LANDFILL AND DISTURBANCE POST - SID
- 61293 WELL LOCATIONS
- 59293 BOREHOLE LOCATION
- 63993 WELL POINT LOCATIONS

CONSTITUENTS (INDICATED WITH SAMPLE DEPTH)

a. Plutonium - 239/240
b. Chromium
c. Copper
d. Manganese
e. Nickel
f. Silver
g. Zinc
h. Aroclor - 1254
i. SVOC's (See Tables 2.4.4.3-1 and 2.4.4.3-2)
j. VOC's (See Tables 2.4.4.3-1 and 2.4.4.3-3)

N

0 100 200

SCALE: 1" = 200'

Drawn NM 5/11/94 Date
Checked TJ 5/11/94 Date
Approved EG&G Date
Approved DOE Date

CONSTITUENTS EXCEEDING BACKGROUND IN MONITORING WELL BOREHOLE SAMPLES IHSS 115/196

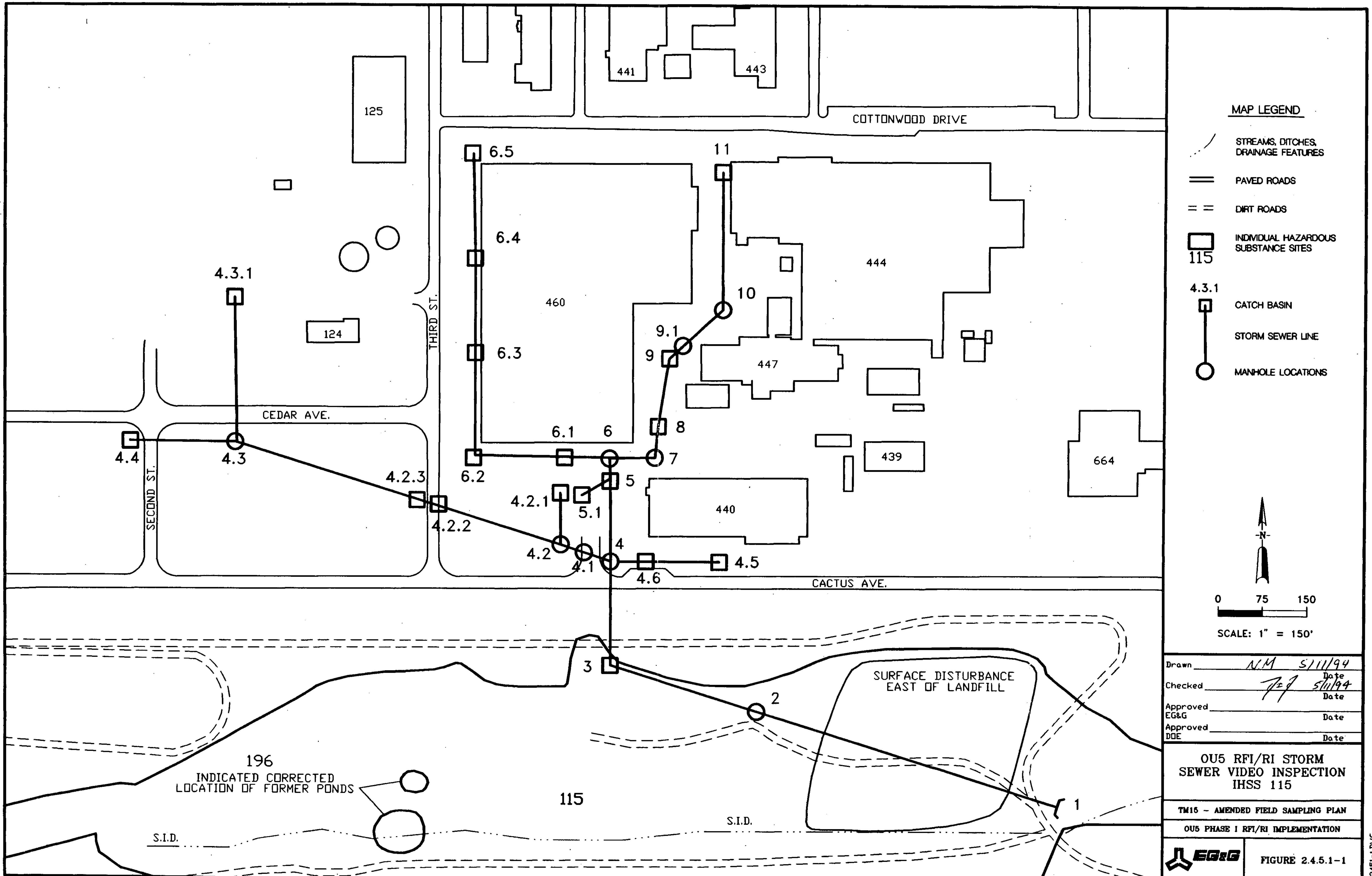
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

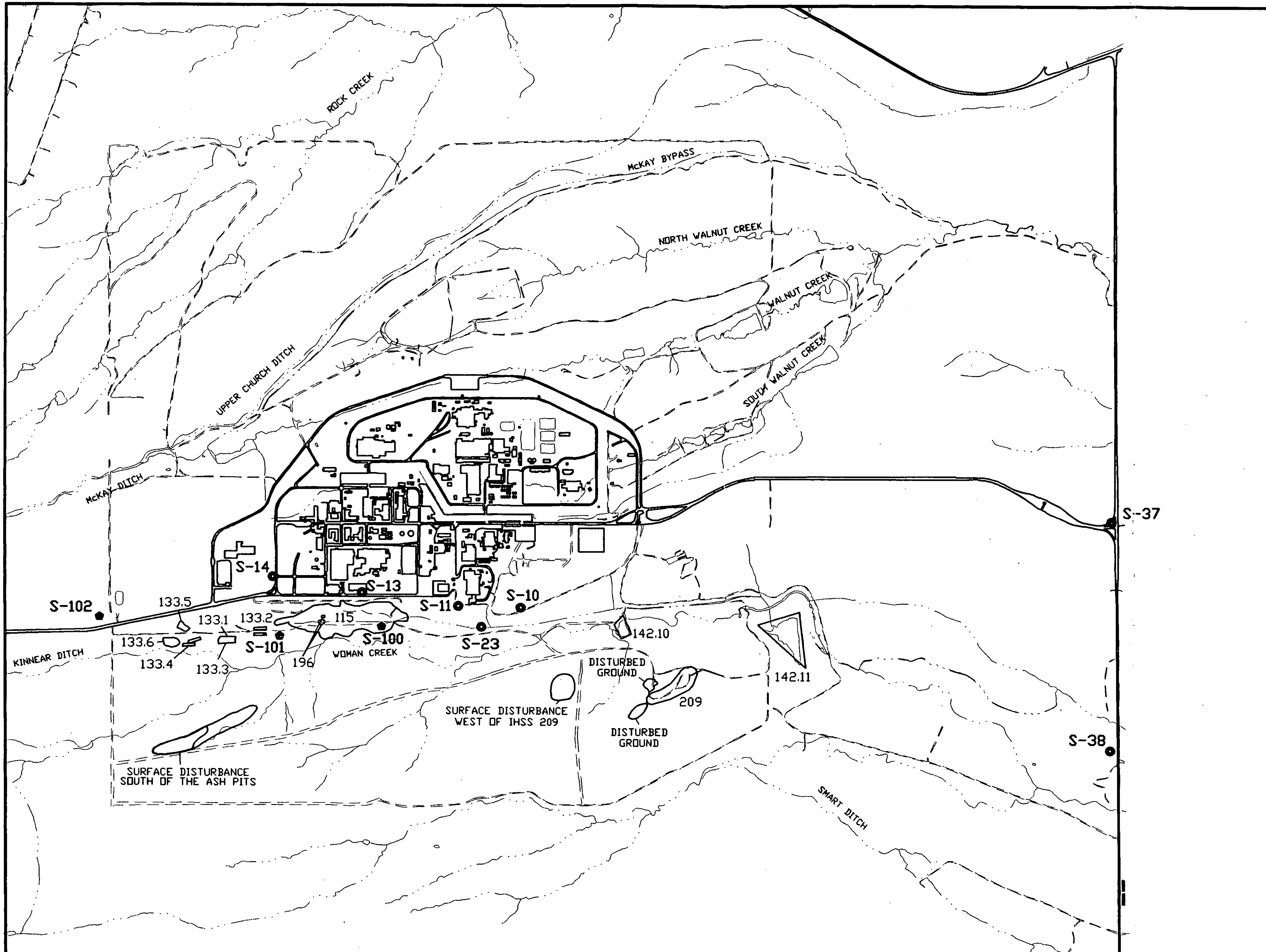
EG&G

FIGURE 2.4.4.3-8

2443-8.DWG



COTTONWOOD DRIVE
CEDAR AVE.
CACTUS AVE.
THIRD ST.
SECOND ST.
125
124
441
443
444
447
460
439
440
664
4.3.1
4.3
4.4
4.2.3
4.2.2
4.2.1
4.2
4.1
4
4.6
4.5
5
5.1
6
6.1
6.2
6.3
6.4
6.5
7
8
9
9.1
10
11
3
2
1
SURFACE DISTURBANCE EAST OF LANDFILL
196
INDICATED CORRECTED LOCATION OF FORMER PONDS
115
S.I.D.
S.I.D.
MAP LEGEND
STREAMS, DITCHES, DRAINAGE FEATURES
PAVED ROADS
DIRT ROADS
115 INDIVIDUAL HAZARDOUS SUBSTANCE SITES
4.3.1 CATCH BASIN
STORM SEWER LINE
MANHOLE LOCATIONS
N
0 75 150
SCALE: 1" = 150'
Drawn N.M 5/11/94 Date
Checked 5/11/94 Date
Approved EG&G Date
Approved DOE Date
OU5 RFI/RI STORM SEWER VIDEO INSPECTION IHSS 115
TM15 - AMENDED FIELD SAMPLING PLAN
OU5 PHASE I RFI/RI IMPLEMENTATION
EG&G
FIGURE 2.4.5.1-1
2451-1.DWG



Drawn	N.M. 5/11/94 Date
Checked	5/11/94 Date
Approved EG&G	Date
Approved DOE	Date

AIR MONITORING STATIONS ALONG WOMAN CREEK AND THE SOUTH INTERCEPTOR DITCH

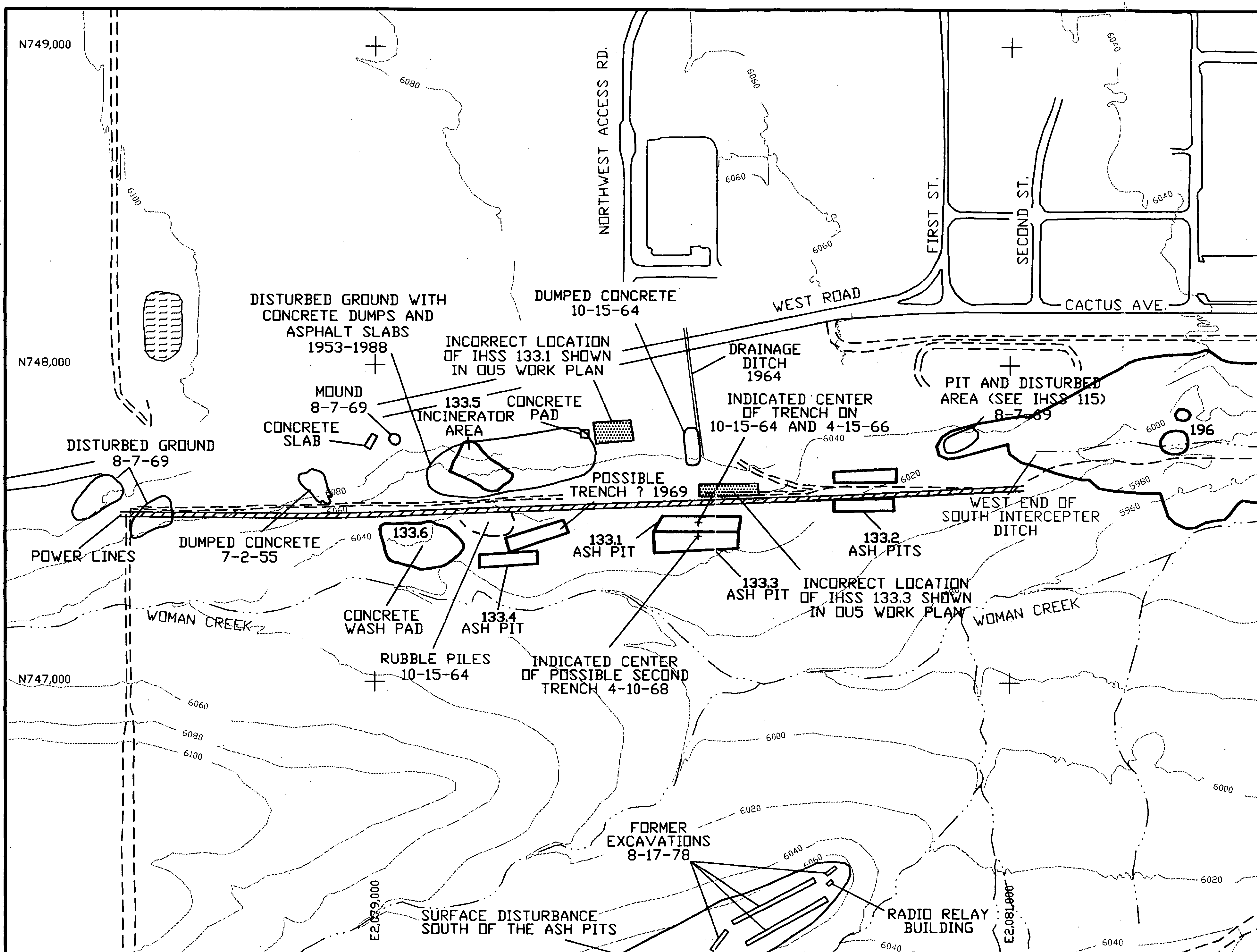
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.4.6.1-2

2461-2.DWG



MAP LEGEND

STREAMS, DITCHES, DRAINAGE FEATURES

PAVED ROADS

DIRT ROADS

SURFACE WATER IMPOUNDMENTS

133.1 INDIVIDUAL HAZARDOUS SUBSTANCE SITES

EXTENDED OR CORRECTED LOCATION FROM AERIAL PHOTOGRAPHS WITH PHOTOGRAPH DATE

POWER LINES

133.1 INCORECT LOCATION OF IHSS SHOWN ON FIGURE 2-6 OF OU5 WORK PLAN

-N-

0 150 300

SCALE: 1" = 300'

Drawn N.M.	5/11/94 Date
Checked [signature]	5/11/94 Date
Approved EG&G	Date
Approved DOE	Date

REVISED LOCATIONS OF IHSS 133 SITES

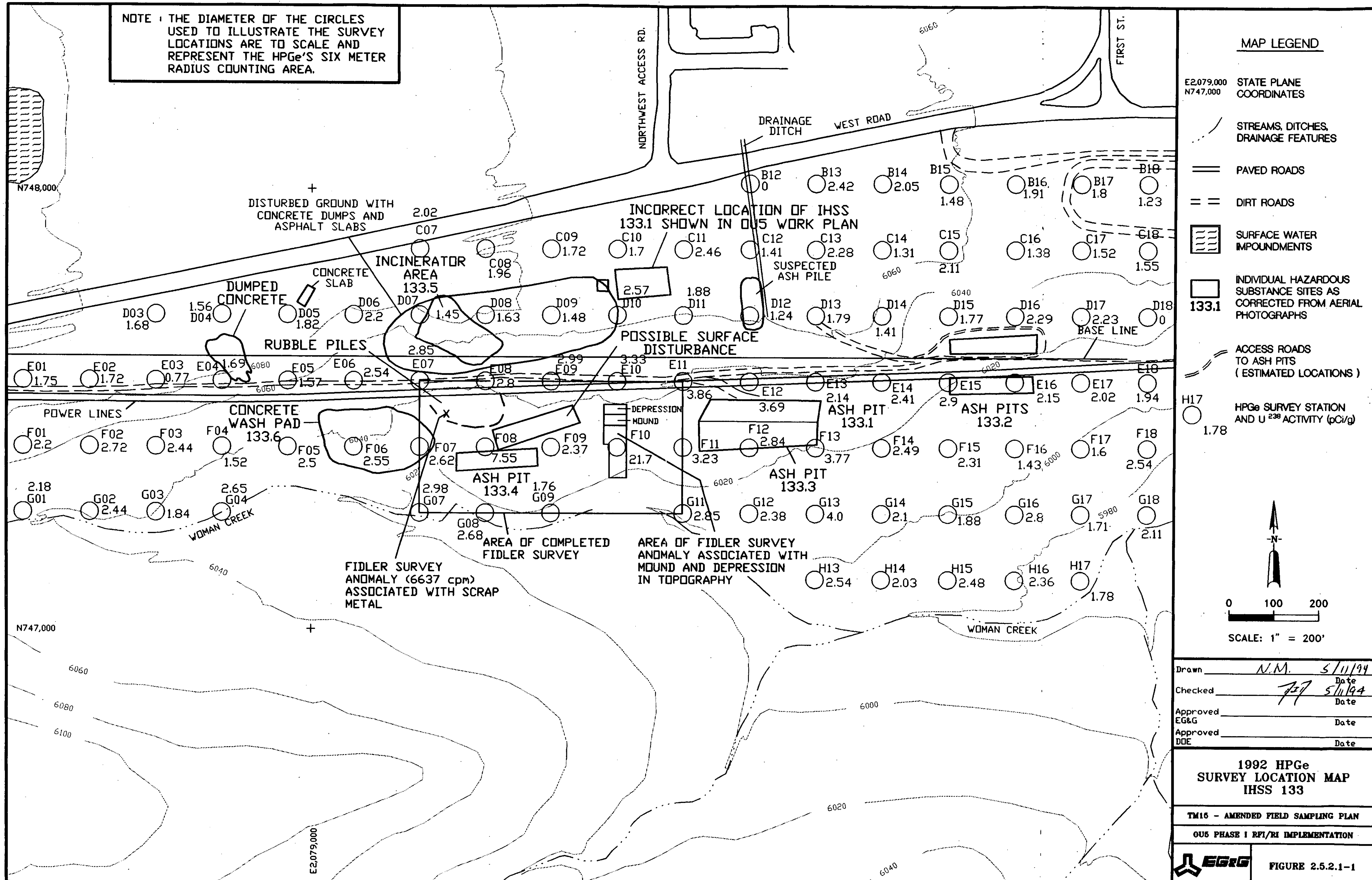
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

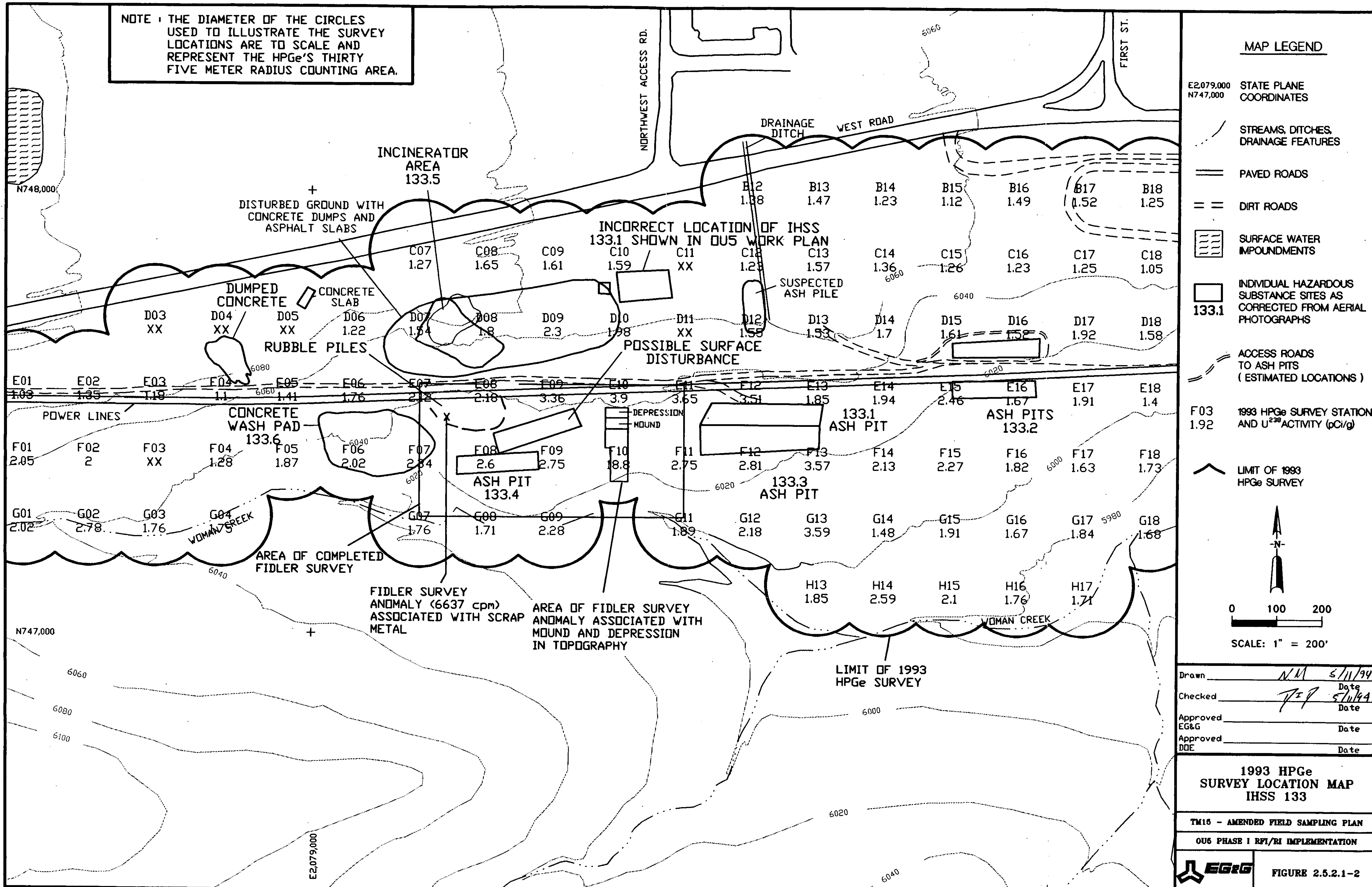
EG&G

FIGURE 2.5.1-1

251-1.DWG



NOTE : THE DIAMETER OF THE CIRCLES USED TO ILLUSTRATE THE SURVEY LOCATIONS ARE TO SCALE AND REPRESENT THE HPGe'S SIX METER RADIUS COUNTING AREA.
NORTHWEST ACCESS RD.
FIRST ST.
WEST ROAD
DRAINAGE DITCH
N748,000
N747,000
E2,079,000
DISTURBED GROUND WITH CONCRETE DUMPS AND ASPHALT SLABS
INCORRECT LOCATION OF IHSS 133.1 SHOWN IN OU5 WORK PLAN
SUSPECTED ASH PILE
INCINERATOR AREA 133.5
CONCRETE SLAB
DUMPED CONCRETE
RUBBLE PILES
POSSIBLE SURFACE DISTURBANCE
BASE LINE
POWER LINES
CONCRETE WASH PAD 133.6
DEPRESSION
MOUND
ASH PIT 133.1
ASH PITS 133.2
ASH PIT 133.3
ASH PIT 133.4
WOMAN CREEK
AREA OF COMPLETED FIDLER SURVEY
FIDLER SURVEY ANOMALY (6637 cpm) ASSOCIATED WITH SCRAP METAL
AREA OF FIDLER SURVEY ANOMALY ASSOCIATED WITH MOUND AND DEPRESSION IN TOPOGRAPHY
B12 0
B13 2.42
B14 2.05
B15 1.48
B16 1.91
B17 1.8
B18 1.23
C07 2.02
C08 1.96
C09 1.72
C10 1.7
C11 2.46
C12 1.41
C13 2.28
C14 1.31
C15 2.11
C16 1.38
C17 1.52
C18 1.55
D03 1.68
D04 1.56
D05 1.82
D06 2.2
D07 1.45
D08 1.63
D09 1.48
D10 2.57
D11 1.88
D12 1.24
D13 1.79
D14 1.41
D15 1.77
D16 2.29
D17 2.23
D18 0
E01 1.75
E02 1.72
E03 0.77
E04 1.69
E05 1.57
E06 2.54
E07 2.85
E08 2.8
E09 2.99
E10 3.33
E11 3.86
E12 3.69
E13 2.14
E14 2.41
E15 2.9
E16 2.15
E17 2.02
E18 1.94
F01 2.2
F02 2.72
F03 2.44
F04 1.52
F05 2.5
F06 2.55
F07 2.62
F08 7.55
F09 2.37
F10 21.7
F11 3.23
F12 2.84
F13 3.77
F14 2.49
F15 2.31
F16 1.43
F17 1.6
F18 2.54
G01 2.18
G02 2.44
G03 1.84
G04 2.65
G07 2.98
G08 2.68
G09 1.76
G11 2.85
G12 2.38
G13 4.0
G14 2.1
G15 1.88
G16 2.8
G17 1.71
G18 2.11
H13 2.54
H14 2.03
H15 2.48
H16 2.36
H17 1.78
6060
6080
6100
6040
6020
6000
5980
MAP LEGEND
E2,079,000 N747,000 STATE PLANE COORDINATES
STREAMS, DITCHES, DRAINAGE FEATURES
PAVED ROADS
DIRT ROADS
SURFACE WATER IMPOUNDMENTS
133.1 INDIVIDUAL HAZARDOUS SUBSTANCE SITES AS CORRECTED FROM AERIAL PHOTOGRAPHS
ACCESS ROADS TO ASH PITS (ESTIMATED LOCATIONS)
H17 1.78 HPGe SURVEY STATION AND U 238 ACTIVITY (pCi/g)
-N-
0 100 200
SCALE: 1" = 200'
Drawn N.M. 5/11/94 Date
Checked 5/11/94 Date
Approved EG&G Date
Approved DOE Date
1992 HPGe SURVEY LOCATION MAP IHSS 133
TM15 - AMENDED FIELD SAMPLING PLAN
OU5 PHASE I RFI/RI IMPLEMENTATION
EG&G
FIGURE 2.5.2.1-1
2521-1.DWG



Drawn N M 5/11/94
Checked 5/11/94
Date
Approved EG&G Date
Approved DOE Date

1993 HPGe SURVEY LOCATION MAP IHSS 133

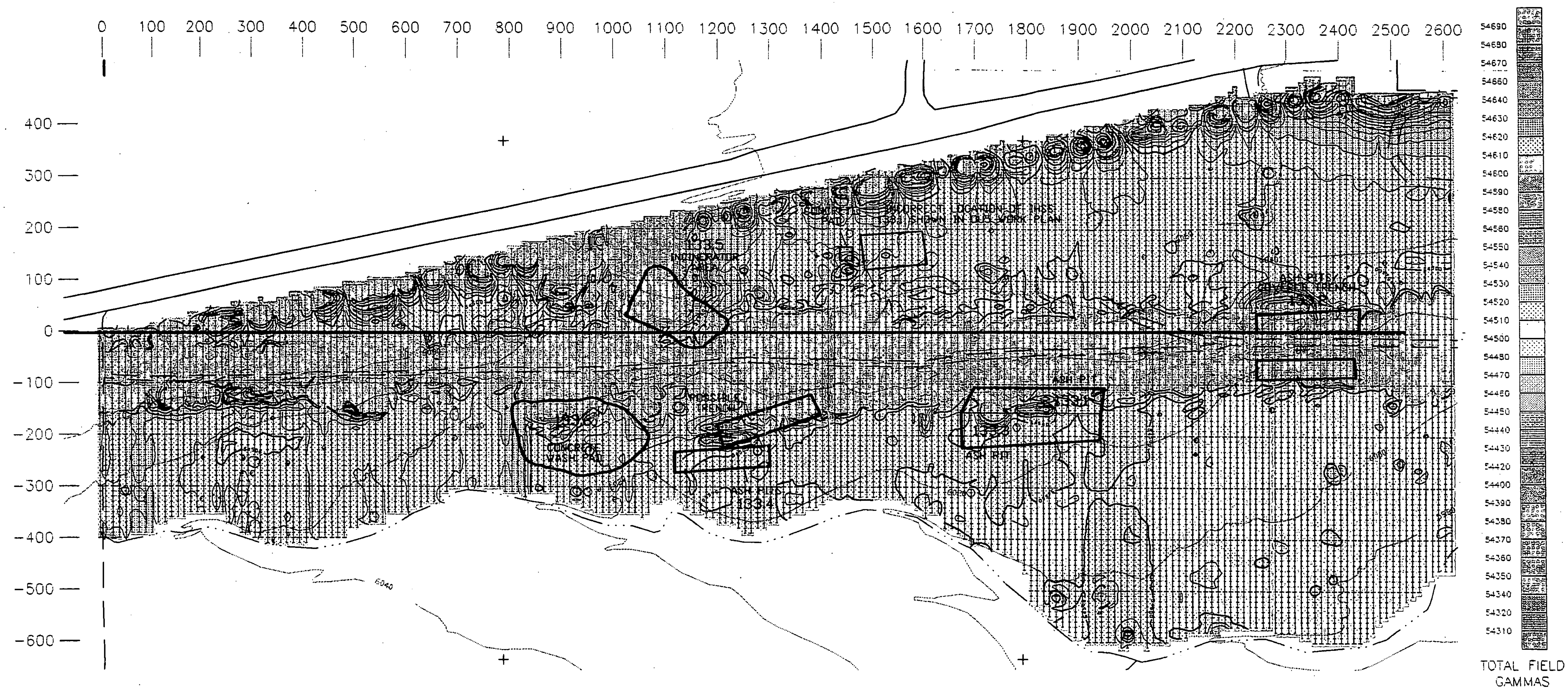
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.5.2.1-2

2521-2.DWG



-N-

0 100 200

SCALE: 1" = 200'

Drawn JH	5/11/94 Date
Checked JH	5/11/94 Date
Approved EG&G	Date
Approved DOE	Date

TOTAL MAGNETIC FIELD
IHSS 133

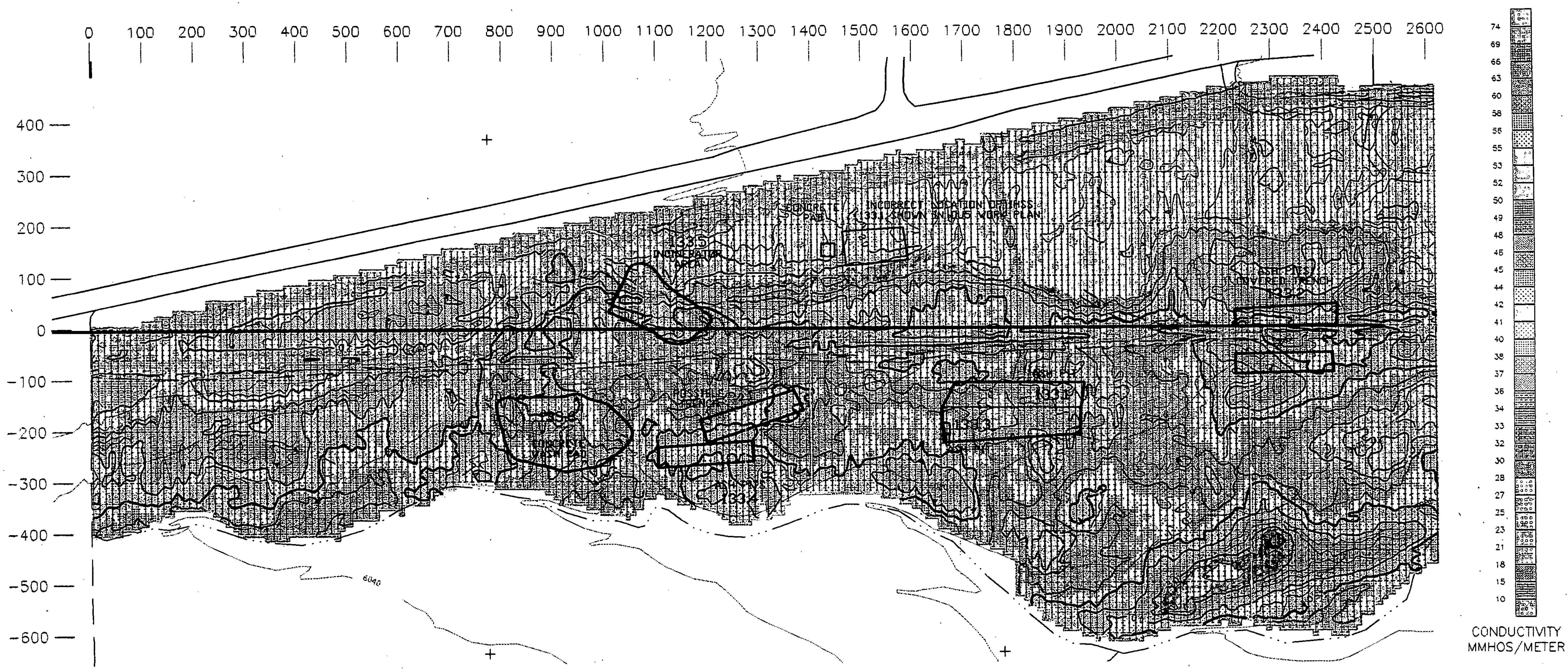
TM15 - AMENDED FIELD SAMPLING PLAN

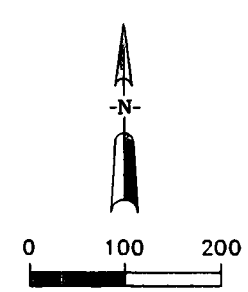
OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.5.2.2-1

2421-1.DWG





SCALE: 1" = 200'

Drawn	JH	5/11/94 Date
Checked	JH	5/11/94 Date
Approved EG&G		Date
Approved DOE		Date

EM 31 CONDUCTIVITY (QUADRATURE PHASE) VERTICAL DIPOLE

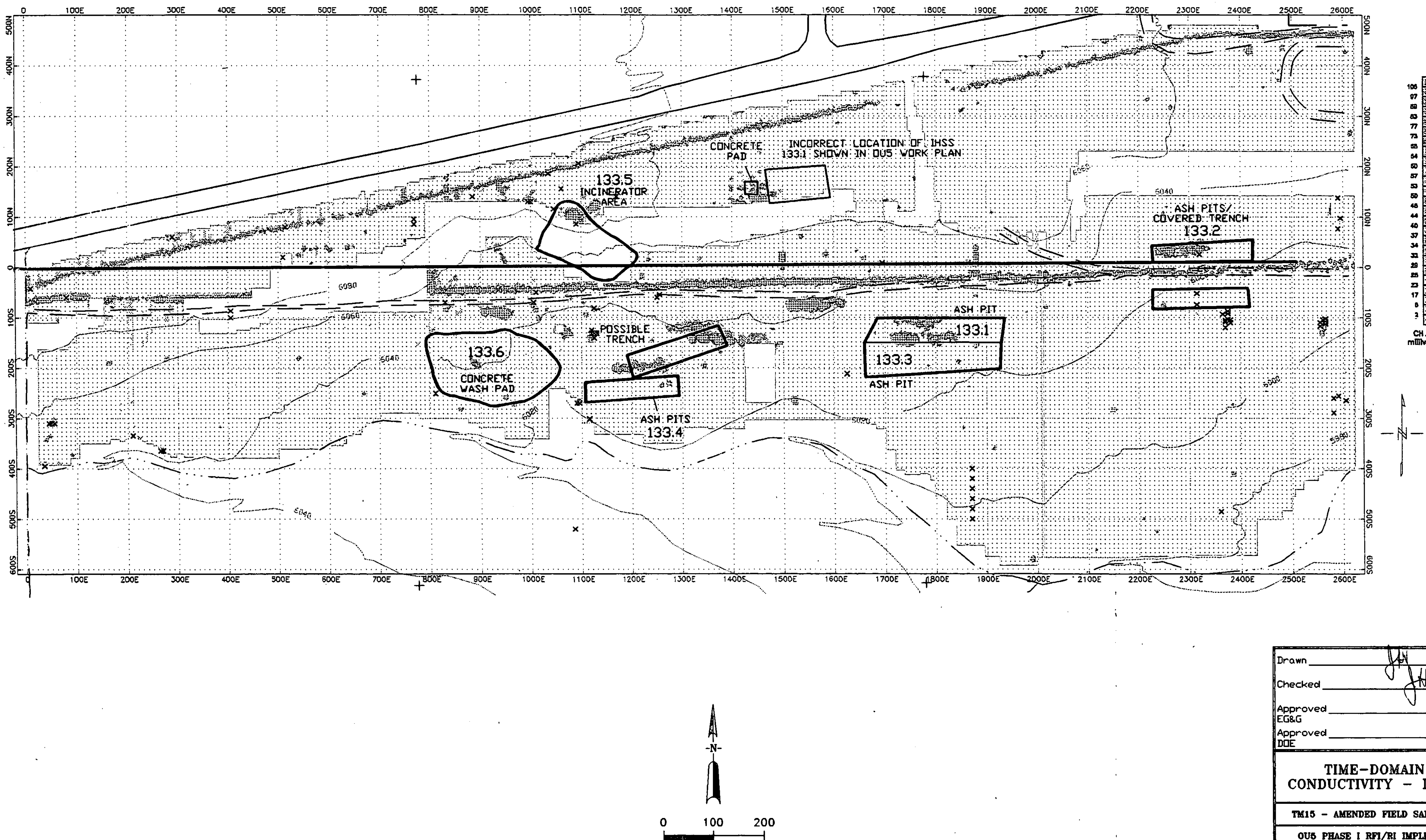
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.5.2.2-2

2421-1.DWG



Drawn	5/11/94 Date
Checked	5/11/94 Date
Approved EG&G	Date
Approved DOE	Date

TIME-DOMAIN EM CONDUCTIVITY - IHSS 133

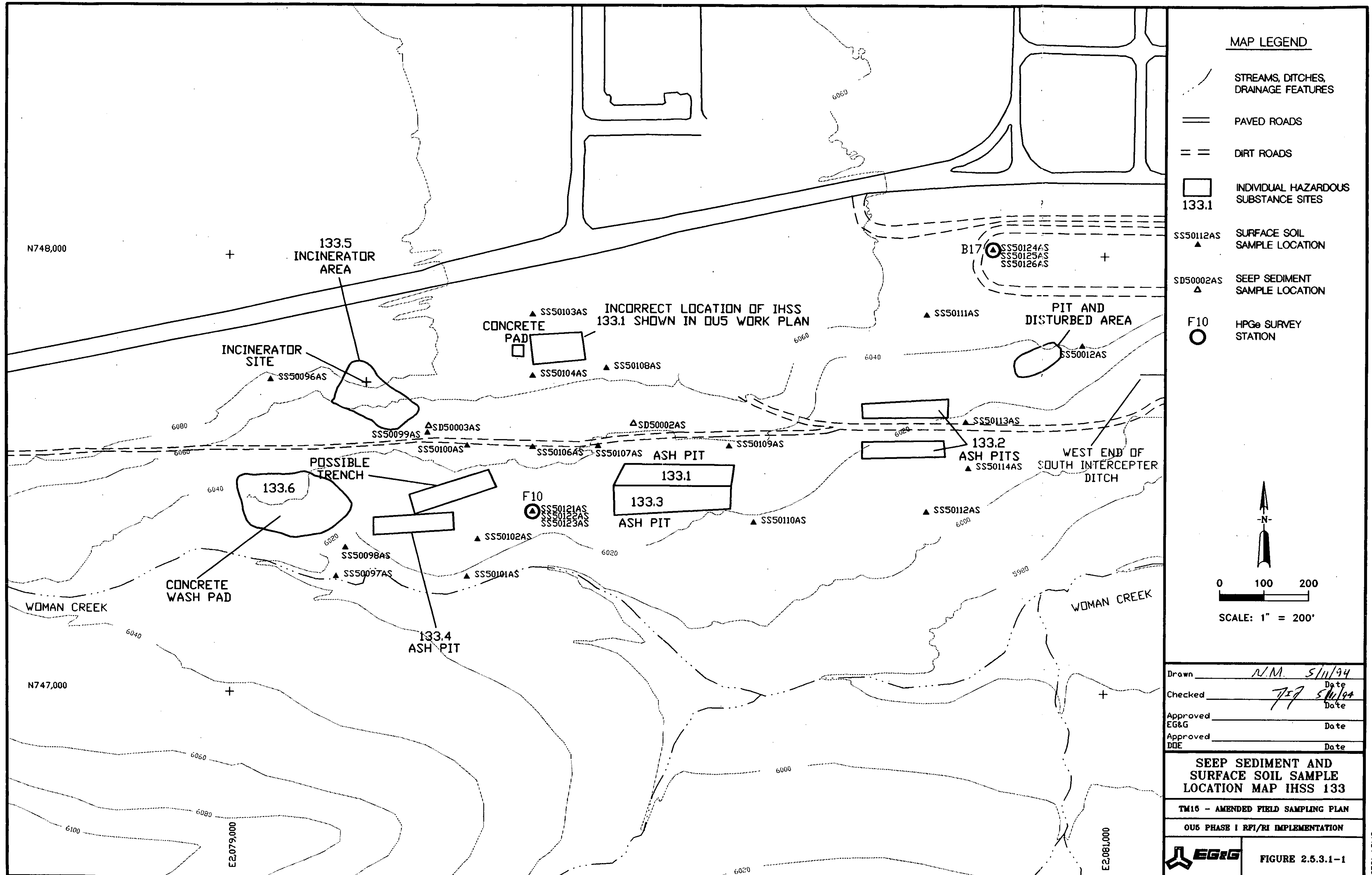
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.5.2.2-3

2421-1.DWG

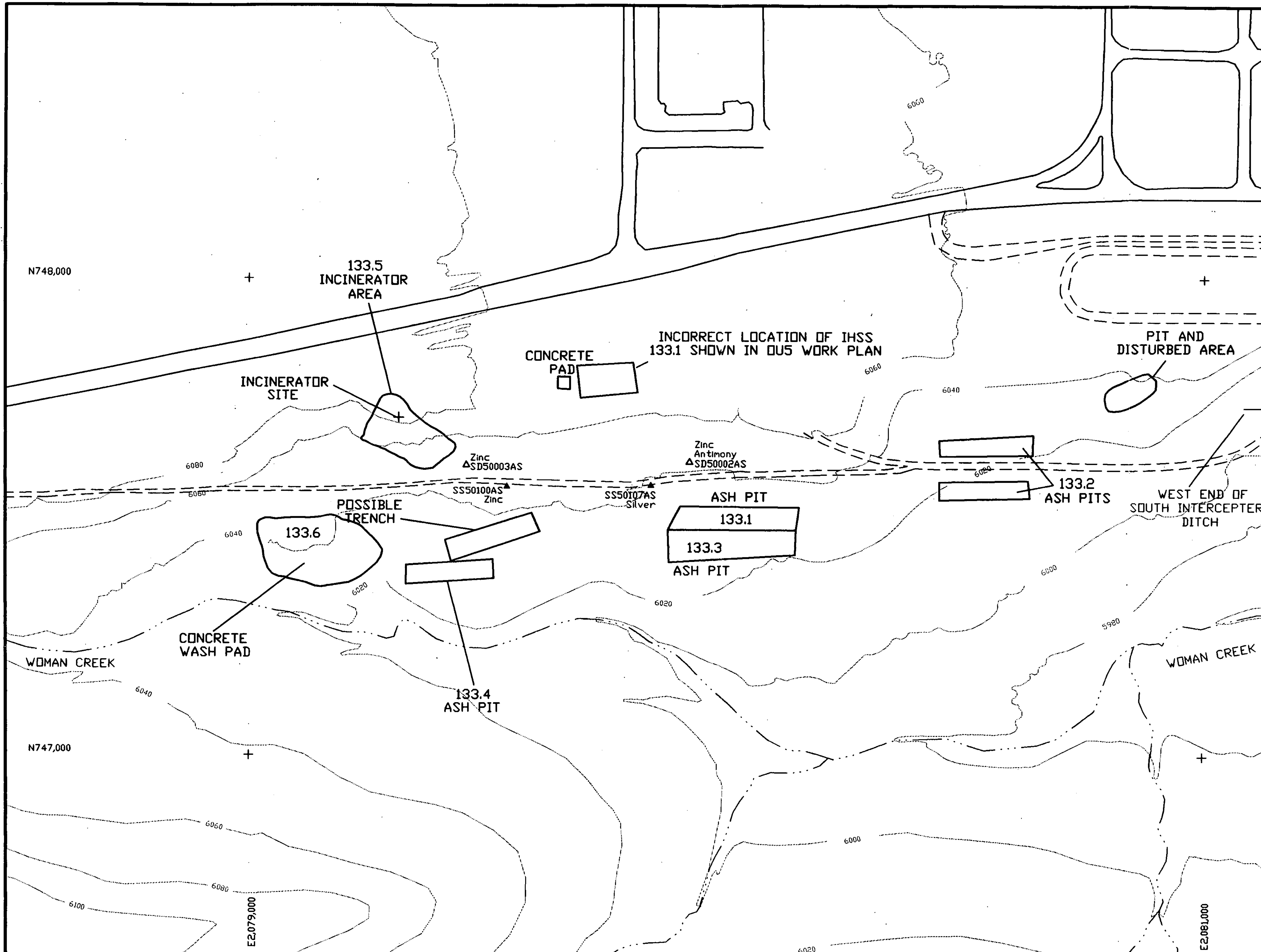


SEEP SEDIMENT AND SURFACE SOIL SAMPLE LOCATION MAP IHSS 133

TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

FIGURE 2.5.3.1-1



MAP LEGEND

STREAMS, DITCHES, DRAINAGE FEATURES

PAVED ROADS

DIRT ROADS

133.1 INDIVIDUAL HAZARDOUS SUBSTANCE SITES

Zinc SS50100AS — SURFACE SOIL SAMPLE LOCATION WITH ANALYTE ABOVE THE BUTL

Zinc SD50002AS — SEEP SEDIMENT SAMPLE LOCATION WITH ANALYTE ABOVE THE BUTL

-N-

0 100 200

SCALE: 1" = 200'

Drawn	N.M.	5/11/94 Date
Checked	[illegible]	5/11/94 Date
Approved EG&G		Date
Approved DOE		Date

SEEP SEDIMENT AND SURFACE SOIL SAMPLES WITH METALS GREATER THAN THE BUTL IHSS 133

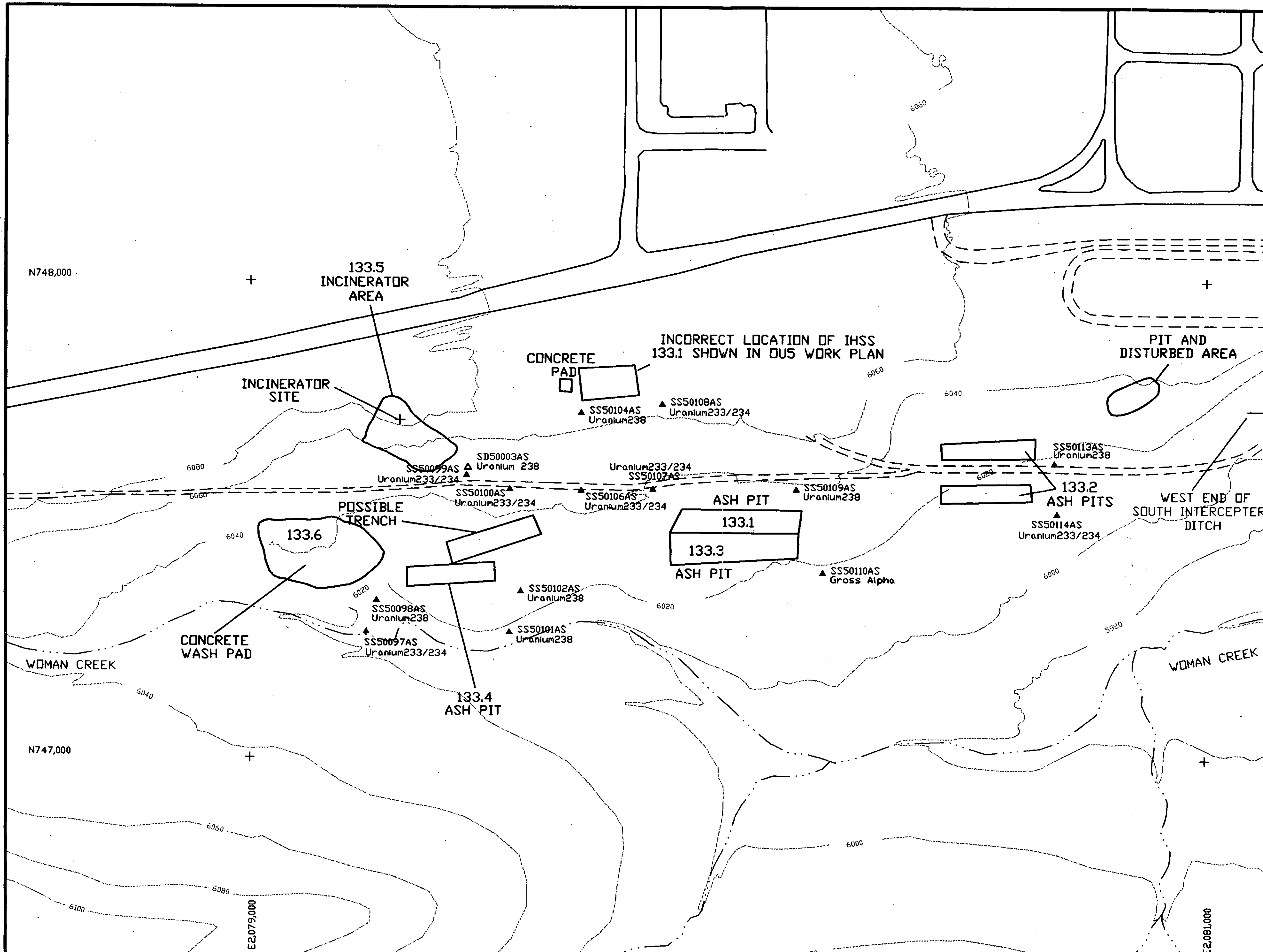
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.5.3.1-2

2531-1.DWG



MAP LEGEND

STREAMS, DITCHES, DRAINAGE FEATURES

PAVED ROADS

DIRT ROADS

133.1 INDIVIDUAL HAZARDOUS SUBSTANCE SITES

Uranium 238 SD50003AS — SEEP SEDIMENT SAMPLE LOCATION WITH ANALYTE ABOVE THE BUTL

Uranium238 SS50102AS — SURFACE SOIL SAMPLE LOCATION WITH ANALYTE ABOVE THE BUTL

-N-

0 100 200

SCALE: 1" = 200'

Drawn	N.M. 5/11/94 Date
Checked	5/11/94 Date
Approved EG&G	Date
Approved DOE	Date

SEEP SEDIMENT AND SURFACE SOIL SAMPLES WITH RADIONUCLIDES GREATER THAN THE BUTL IHHS 133

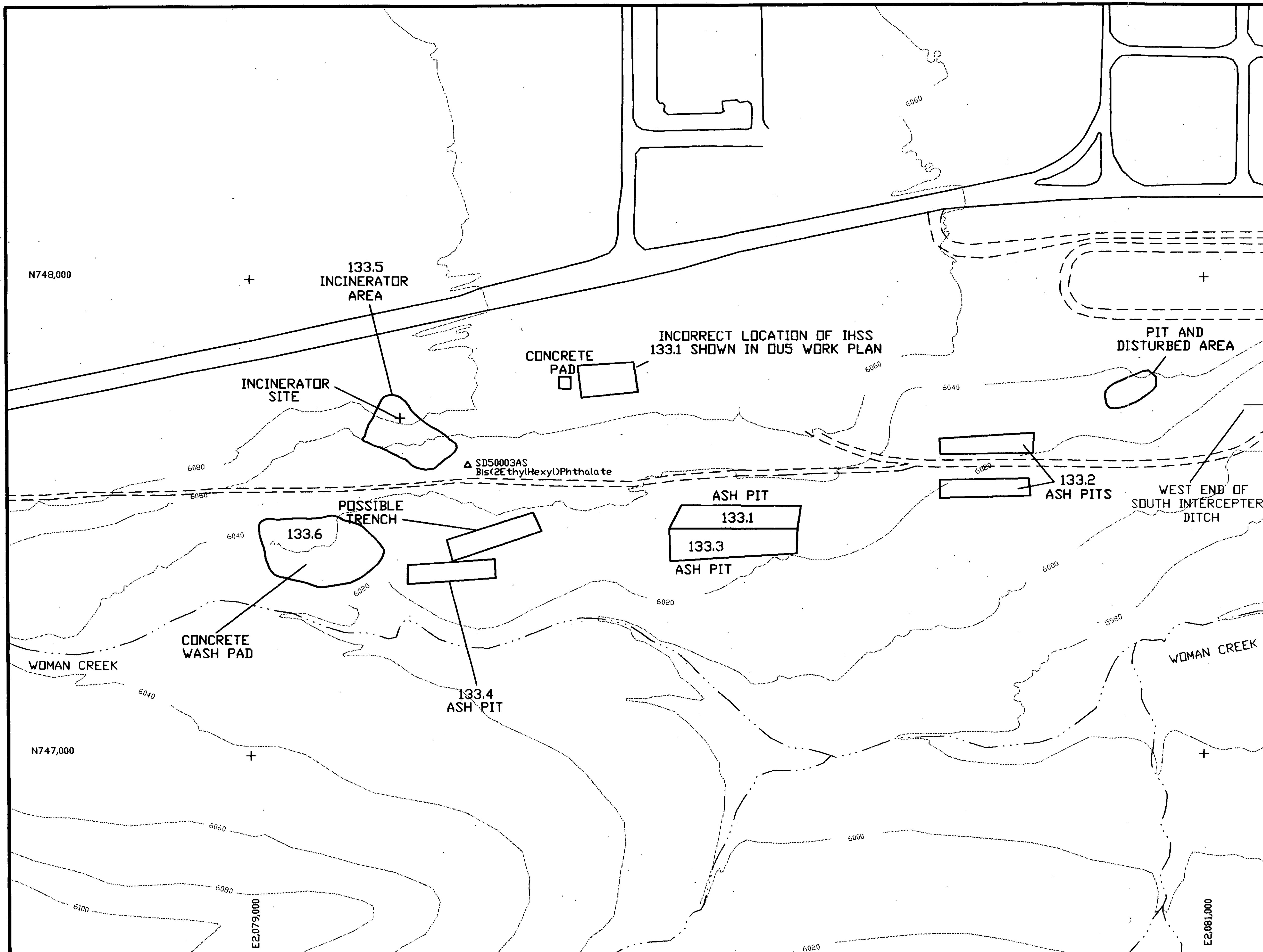
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.5.3.1-3

2531-1.DWG



MAP LEGEND

STREAMS, DITCHES, DRAINAGE FEATURES

PAVED ROADS

DIRT ROADS

133.1 INDIVIDUAL HAZARDOUS SUBSTANCE SITES

SD50003AS Δ Bis(2EthylHexyl)Phthalate — SEEP SEDIMENT SAMPLE LOCATION WITH ANALYTE ABOVE THE DETECTION LIMIT

-N-

0 100 200

SCALE: 1" = 200'

Drawn	N.M	5/11/94 Date
Checked		5/11/94 Date
Approved EG&G		Date
Approved DOE		Date

SEEP SEDIMENT SAMPLE WITH DETECTED SEMI-VOLATILE ORGANIC COMPOUNDS IHSS 133

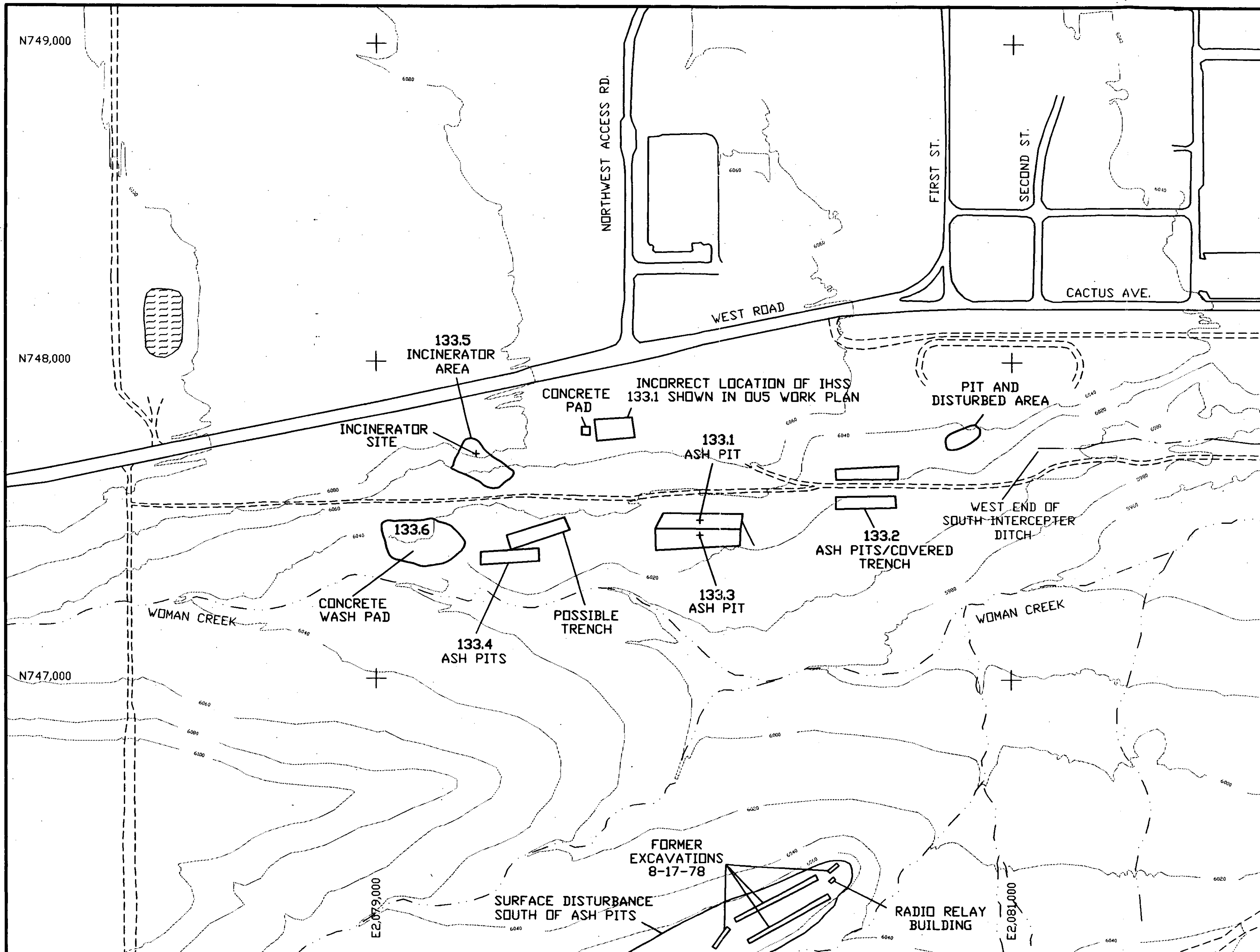
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.5.3.1-4

2531-1.DWG



MAP LEGEND

STREAMS, DITCHES, DRAINAGE FEATURES

PAVED ROADS

DIRT ROADS

SURFACE WATER IMPOUNDMENTS

133.1 INDIVIDUAL HAZARDOUS SUBSTANCE SITES

-N-

0 150 300

SCALE: 1" = 300'

Drawn N.M.	5/11/94 Date
Checked TF	5/11/94 Date
Approved EG&G	Date
Approved DOE	Date

IHSS 133 LOCATION MAP

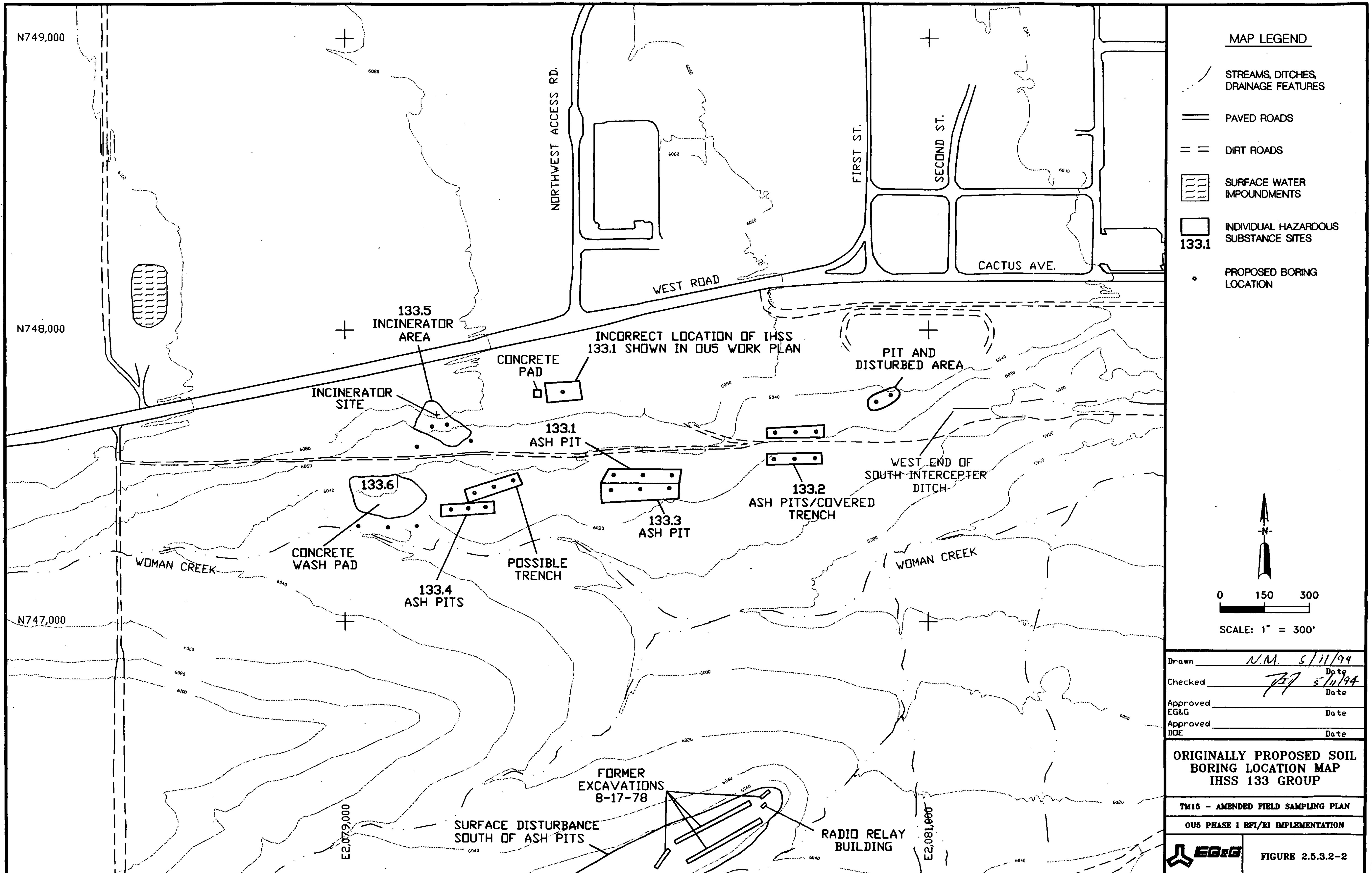
TM15 - AMENDED FIELD SAMPLING PLAN

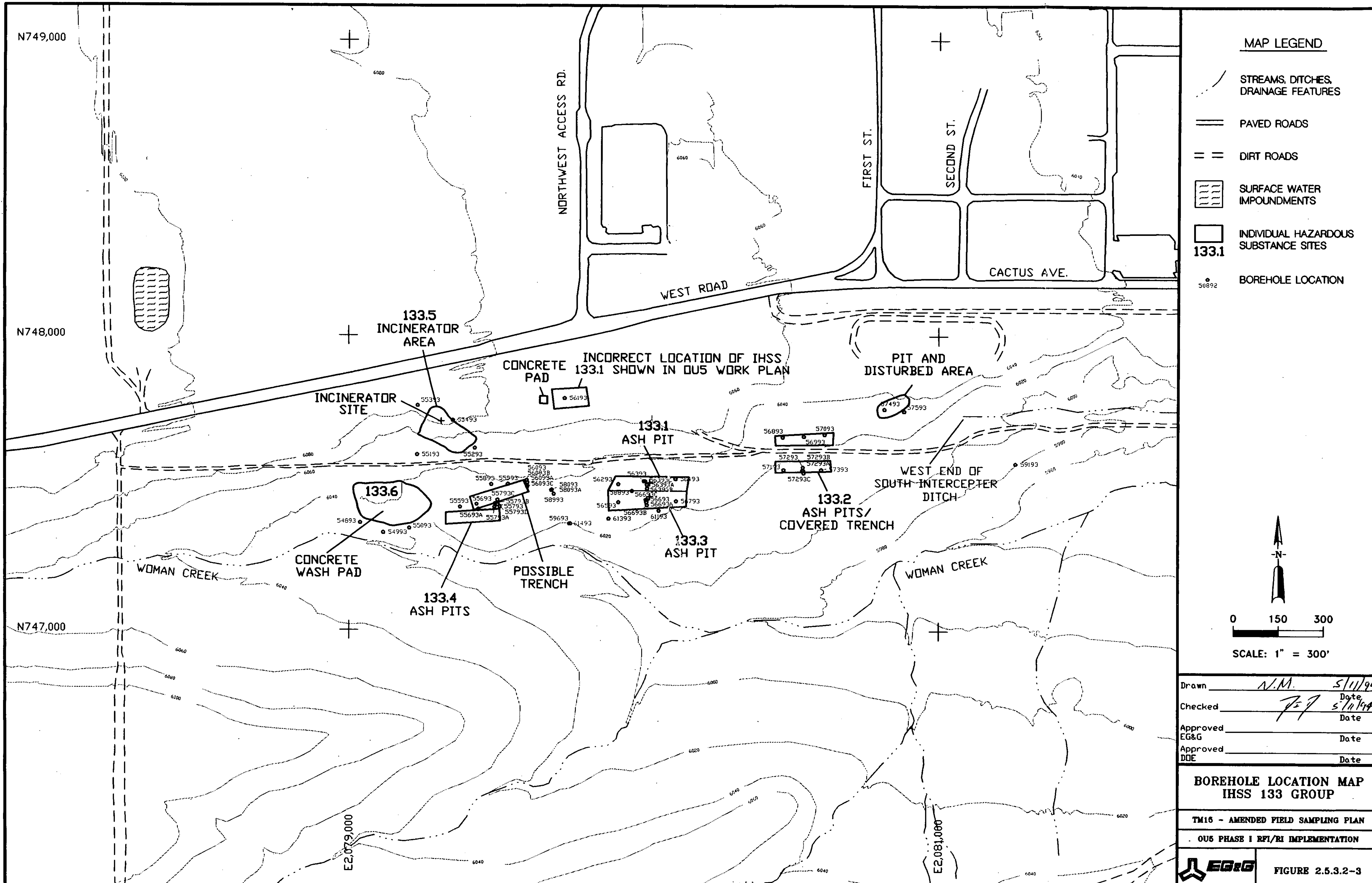
OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

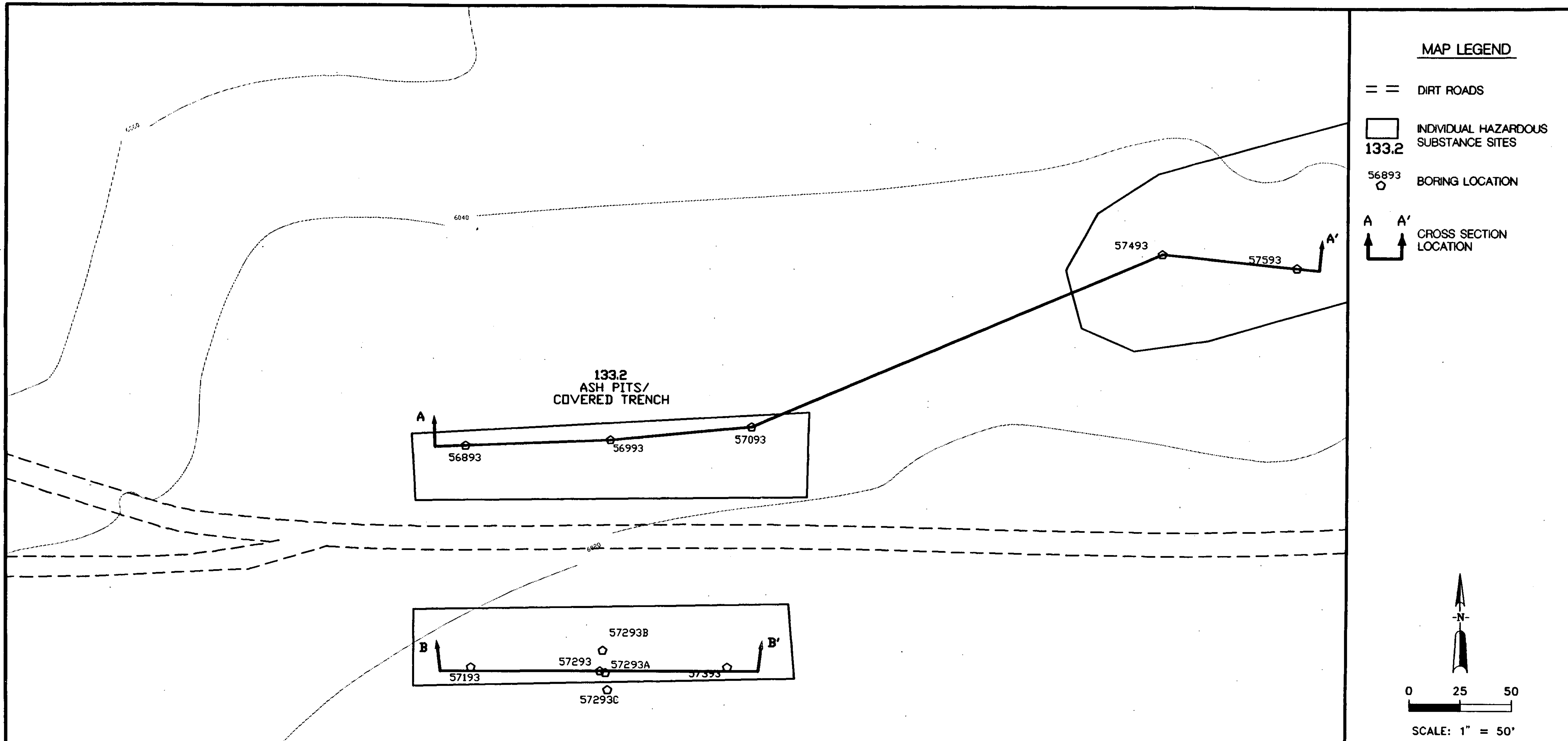
FIGURE 2.5.3.2-1

2532-1.DWG


N749,000
N748,000
N747,000
NORTHWEST ACCESS RD.
FIRST ST.
SECOND ST.
CACTUS AVE.
WEST ROAD
133.5
INCINERATOR
AREA
INCINERATOR
SITE
CONCRETE
PAD
INCORRECT LOCATION OF IHSS
133.1 SHOWN IN OU5 WORK PLAN
PIT AND
DISTURBED AREA
133.1
ASH PIT
133.6
133.3
ASH PIT
133.2
ASH PITS/COVERED
TRENCH
WEST END OF
SOUTH INTERCEPTER
DITCH
WOMAN CREEK
CONCRETE
WASH PAD
POSSIBLE
TRENCH
133.4
ASH PITS
FORMER
EXCAVATIONS
8-17-78
SURFACE DISTURBANCE
SOUTH OF ASH PITS
RADIO RELAY
BUILDING
E2,079,000
E2,081,000
MAP LEGEND
STREAMS, DITCHES, DRAINAGE FEATURES
PAVED ROADS
DIRT ROADS
SURFACE WATER IMPOUNDMENTS
INDIVIDUAL HAZARDOUS SUBSTANCE SITES
133.1
PROPOSED BORING LOCATION
-N-
0 150 300
SCALE: 1" = 300'
Drawn N.M. 5/11/94 Date
Checked 5/11/94 Date
Approved EG&G Date
Approved DOE Date
ORIGINALLY PROPOSED SOIL BORING LOCATION MAP IHSS 133 GROUP
TM15 - AMENDED FIELD SAMPLING PLAN
OU5 PHASE I RFI/RI IMPLEMENTATION
EG&G
FIGURE 2.5.3.2-2
2532-2.DWG



MAP LEGEND
STREAMS, DITCHES, DRAINAGE FEATURES
PAVED ROADS
DIRT ROADS
SURFACE WATER IMPOUNDMENTS
INDIVIDUAL HAZARDOUS SUBSTANCE SITES
133.1
BOREHOLE LOCATION
50892
N749,000
N748,000
N747,000
E2,079,000
E2,081,000
NORTHWEST ACCESS RD.
FIRST ST.
SECOND ST.
CACTUS AVE.
WEST ROAD
133.5
INCINERATOR AREA
INCINERATOR SITE
CONCRETE PAD
INCORRECT LOCATION OF IHSS 133.1 SHOWN IN OU5 WORK PLAN
PIT AND DISTURBED AREA
133.1
ASH PIT
133.2
ASH PITS/ COVERED TRENCH
133.3
ASH PIT
133.4
ASH PITS
133.6
CONCRETE WASH PAD
POSSIBLE TRENCH
WEST END OF SOUTH INTERCEPTER DITCH
WOMAN CREEK
WOMAN CREEK
-N-
0
150
300
SCALE: 1" = 300'
Drawn N.M. 5/11/94
Date
Checked 5/11/94
Date
Approved EG&G
Date
Approved DOE
Date
BOREHOLE LOCATION MAP
IHSS 133 GROUP
TM15 - AMENDED FIELD SAMPLING PLAN
OU5 PHASE I RFI/RI IMPLEMENTATION
EG&G
FIGURE 2.5.3.2-3
2532-3.DWG



Drawn N.M 5/11/94 Date
Checked Date
Approved EG&G Date
Approved DOE Date

BOREHOLE LOCATION MAP WITH CROSS SECTION LOCATIONS IHSS 133.2

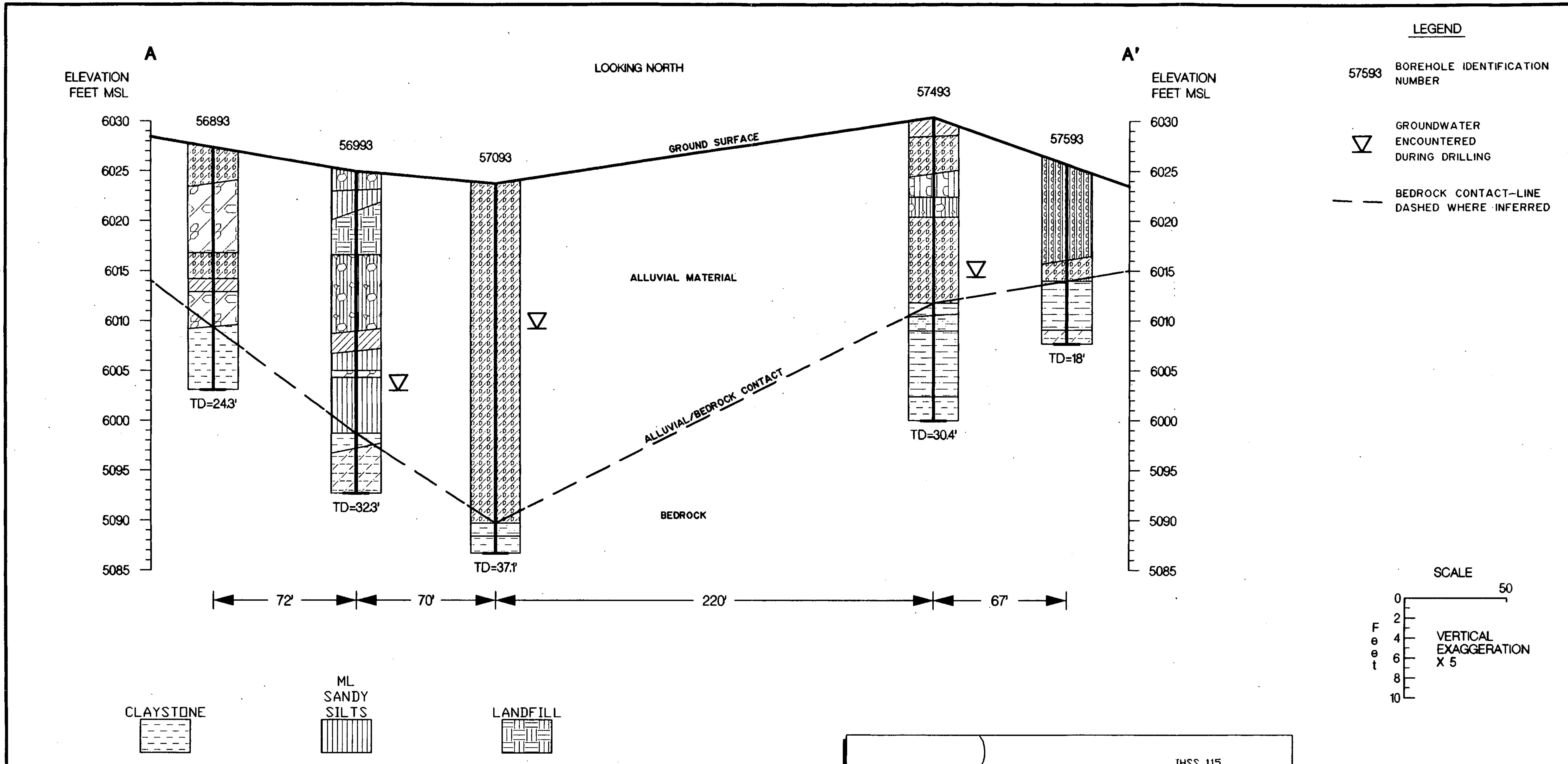
TM15 - AMENDED FIELD SAMPLING PLAN

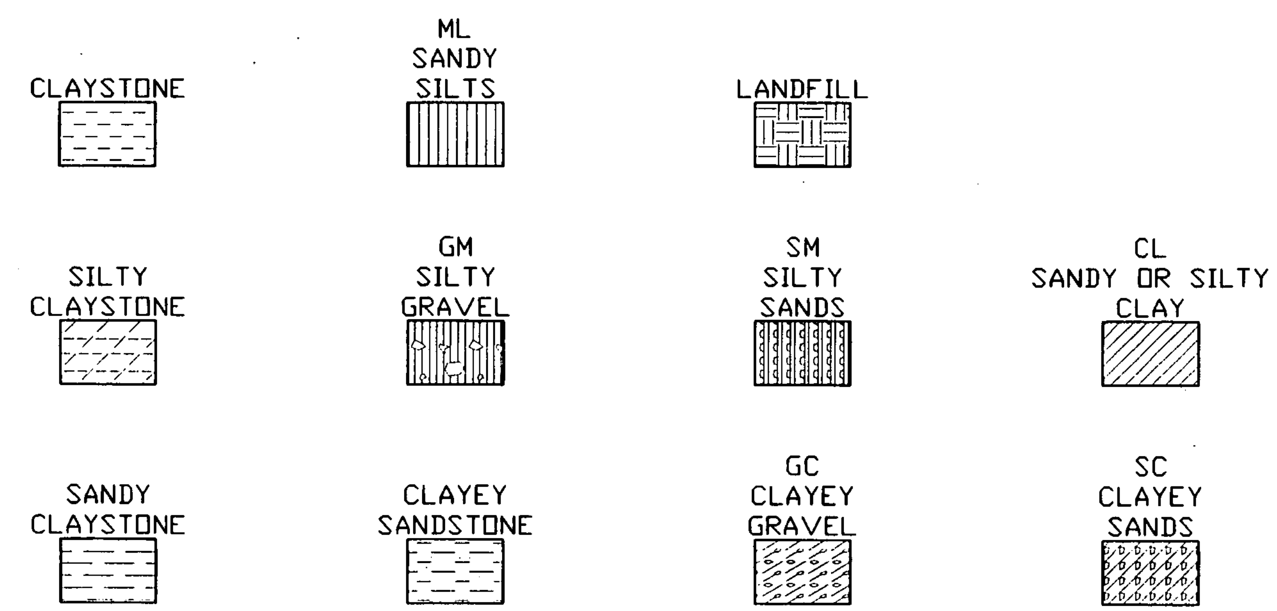
OU5 PHASE I RFI/RI IMPLEMENTATION

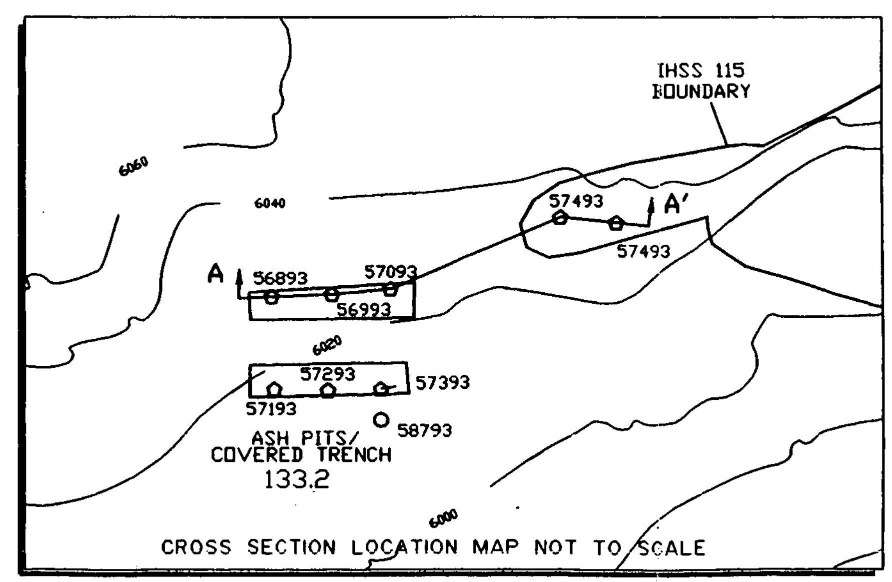
EG&G

FIGURE 2.5.3.2-4

2532-4.DWG







Drawn	5/13/94 Date
Checked	5/13/94 Date
Approved EG&G	Date
Approved DOE	Date

GENERALIZED GEOLOGIC CROSS SECTION A–A' IHSS 133.2 AND PIT AND DISTURBED AREA

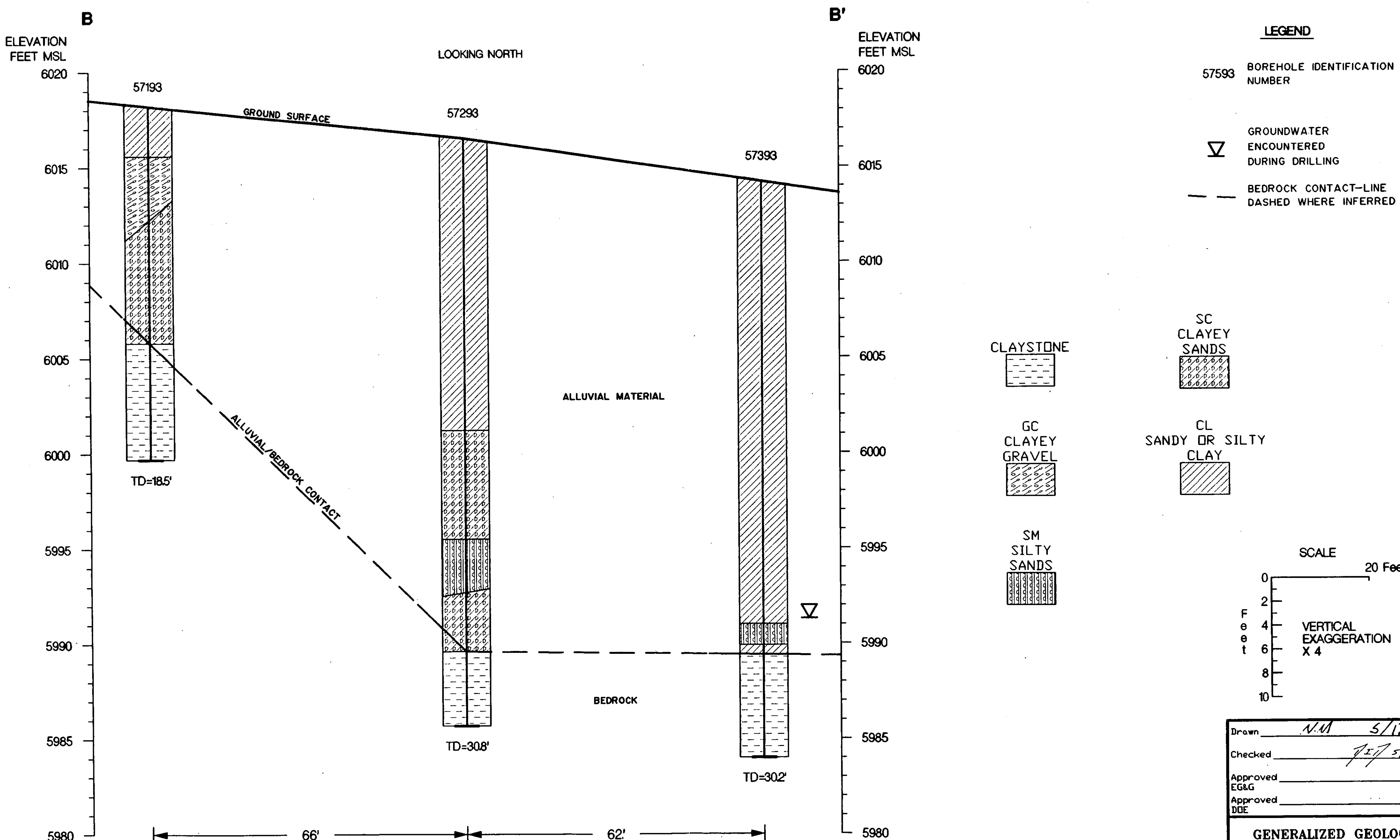
TM15 – AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.5.3.2–5

2532-6DWG



NOTE: SEE FIGURE 2.5.3.2-4 FOR CROSS SECTION LOCATION

Drawn N.M.	5/13/94 Date
Checked	5/13/94 Date
Approved EG&G	Date
Approved DOE	Date

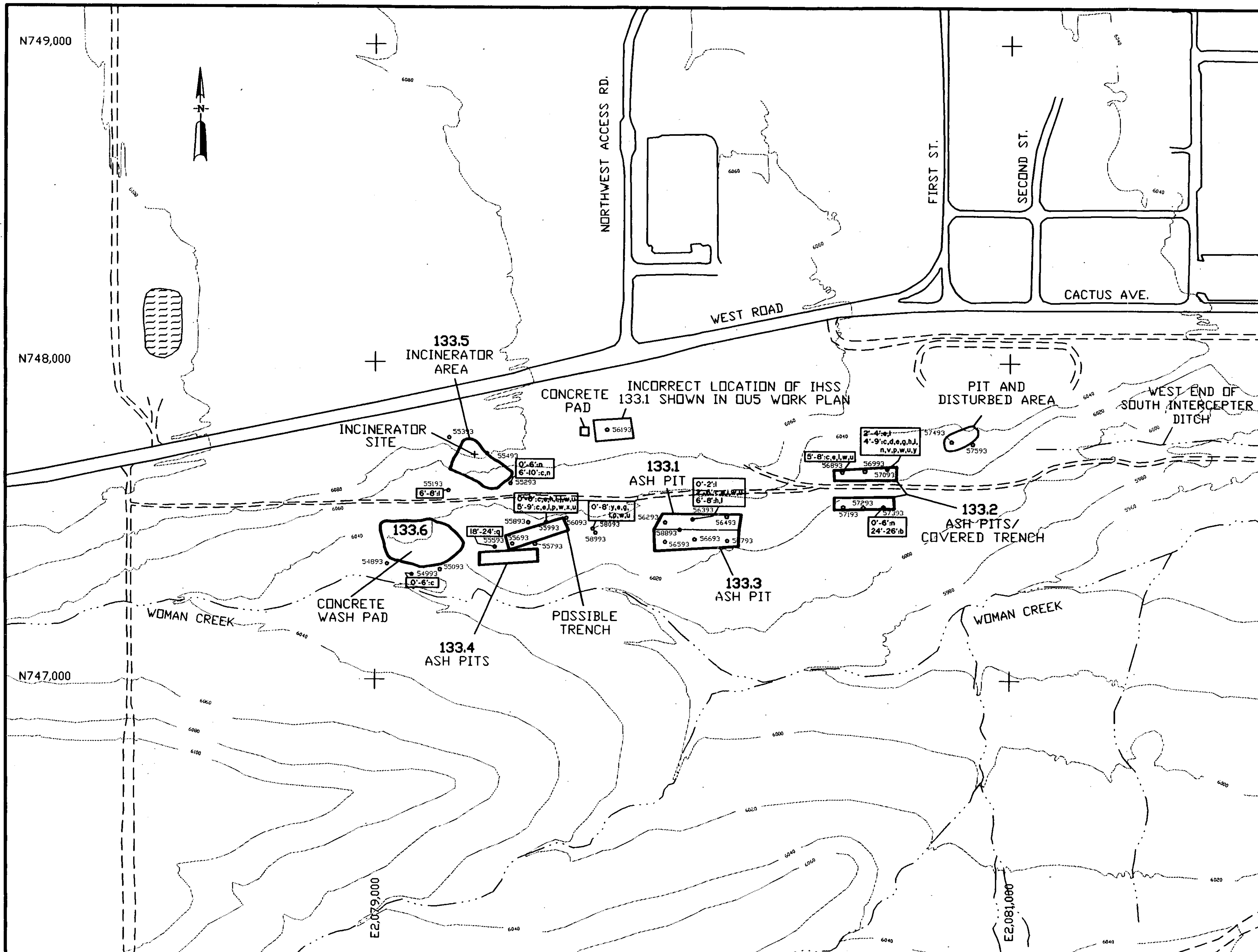
GENERALIZED GEOLOGIC CROSS SECTION B-B' IHSS 133.2

TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G FIGURE 2.5.3.2-6

2532-6DWG



MAP LEGEND

- STREAMS, DITCHES, DRAINAGE FEATURES
- PAVED ROADS
- DIRT ROADS
- SURFACE WATER IMPOUNDMENTS
- 133.1 INDIVIDUAL HAZARDOUS SUBSTANCE SITES
- 50892 BOREHOLE LOCATION

CONSTITUENTS (WITH DEPTH INDICATED)

a = ALUMINUM
b = ARSENIC
c = BARIUM
d = BERYLLIUM
e = CADMIUM
f = CALCIUM
g = CHROMIUM
h = COBALT
i = COPPER
j = IRON
k = LEAD
l = LITHIUM
m = MAGNESIUM
n = MANGANESE
o = MERCURY
p = NICKEL
q = POTASSIUM
r = SILICON
s = STRONTIUM
t = VANADIUM
u = ZINC
v = MOLYBDENUM
w = SILVER
x = TIN
y = ANTIMONY

0 150 300

SCALE: 1" = 300'

Drawn	N.M. 5/11/94 Date
Checked	5/11/94 Date
Approved EG&G	Date
Approved DOE	Date

METALS DETECTED EXCEEDING BUTLS IN BOREHOLE SOIL SAMPLES IHSS 133 GROUP

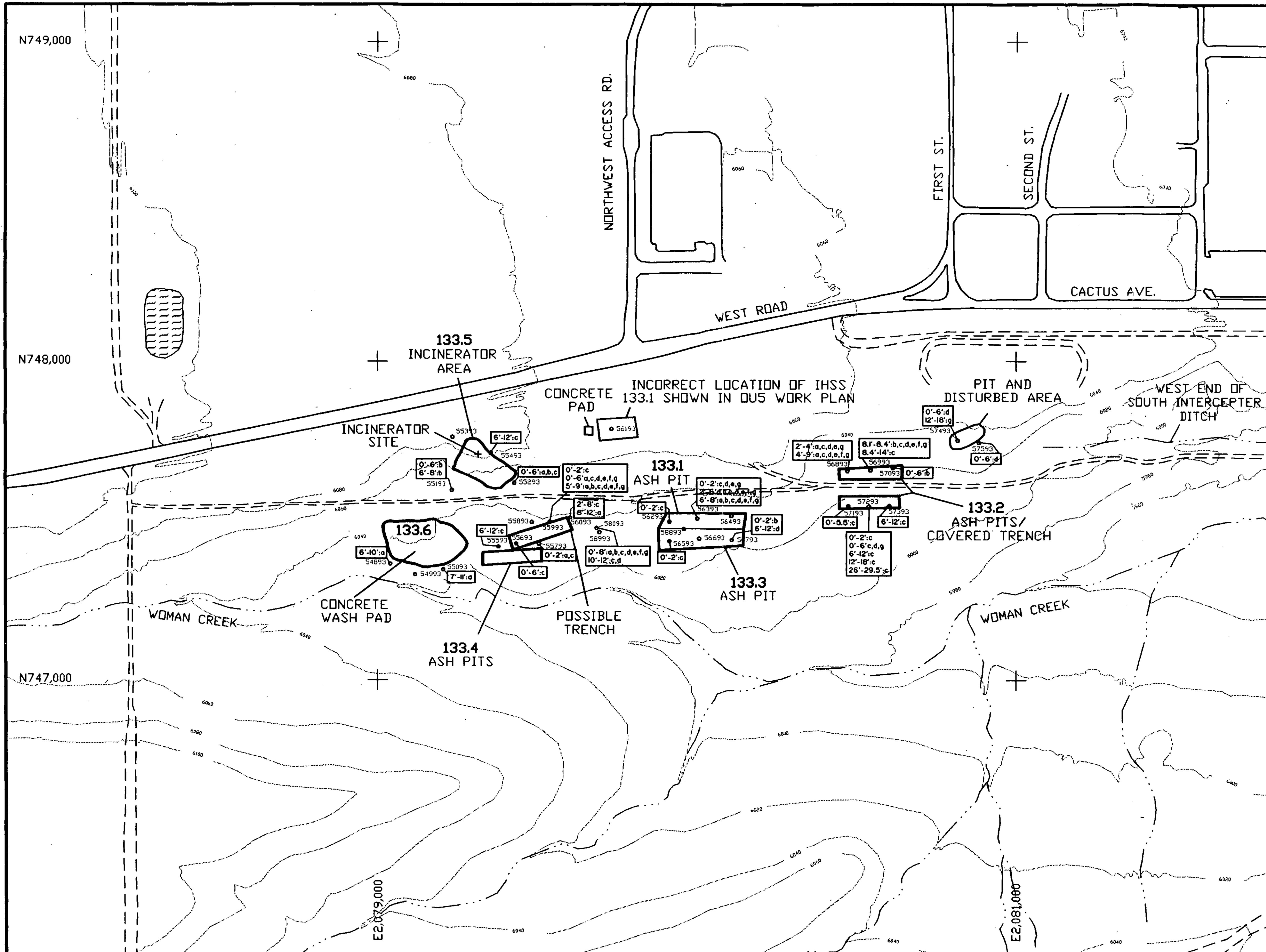
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.5.3.2-7

2532-7.DWG



MAP LEGEND

STREAMS, DITCHES, DRAINAGE FEATURES

PAVED ROADS

DIRT ROADS

SURFACE WATER IMPOUNDMENTS

133.1 INDIVIDUAL HAZARDOUS SUBSTANCE SITES

50892 BOREHOLE LOCATION

CONSTITUENTS (WITH DEPTH INDICATED)

- a = PLUTONIUM - 239/240
- b = AMERICIUM - 241
- c = URANIUM - 238
- d = URANIUM - 235
- e = URANIUM - 233,234
- f = GROSS ALPHA
- g = GROSS BETA

N

0 150 300

SCALE: 1" = 300'

Drawn NM 5/11/94 Date

Checked [signature] 5/11/94 Date

Approved EG&G Date

Approved DOE Date

RADIONUCLIDES DETECTED EXCEEDING BUTLS IN BOREHOLE SOIL SAMPLES IHSS 133 GROUP

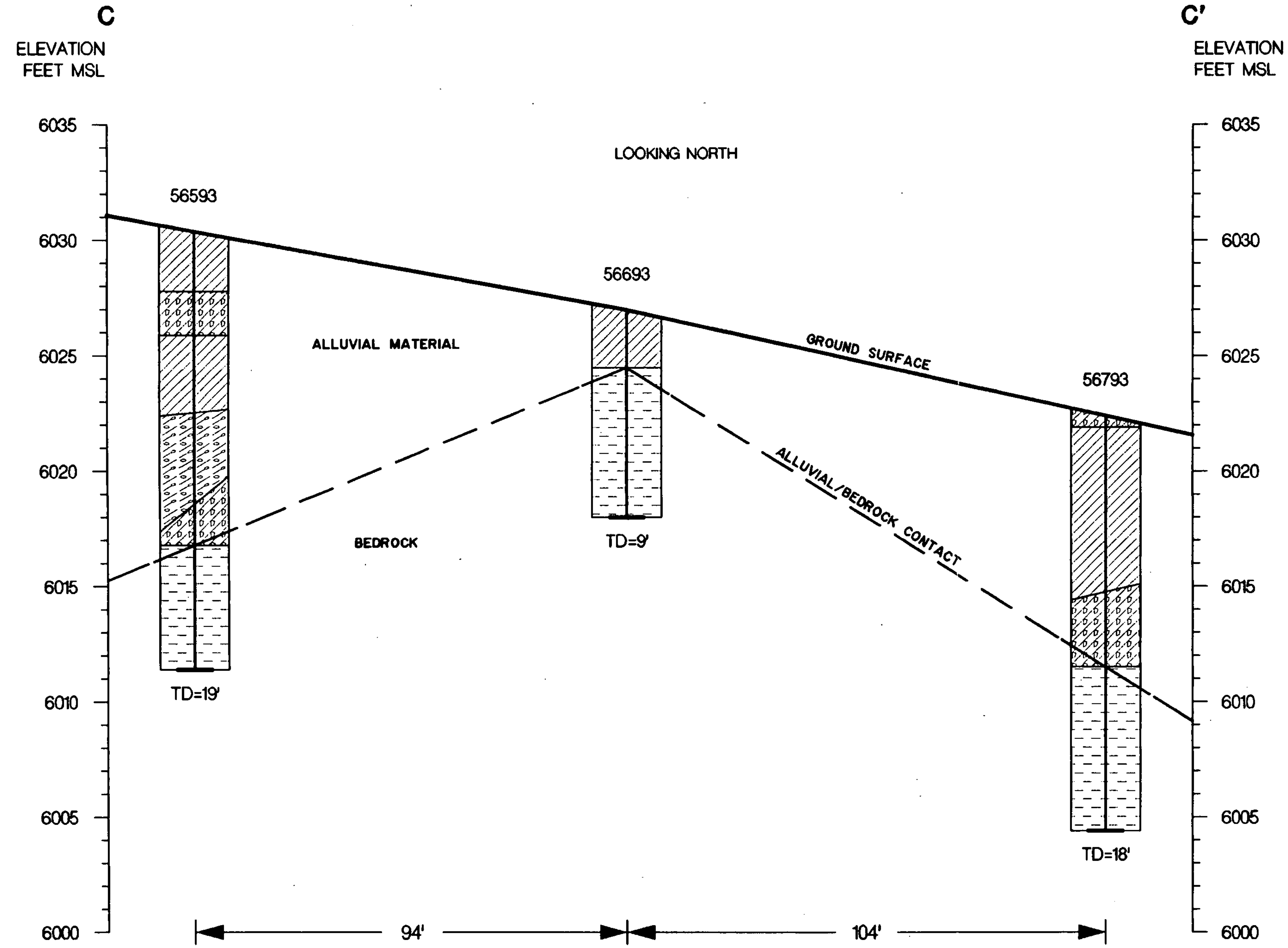
TM15 - AMENDED FIELD SAMPLING PLAN

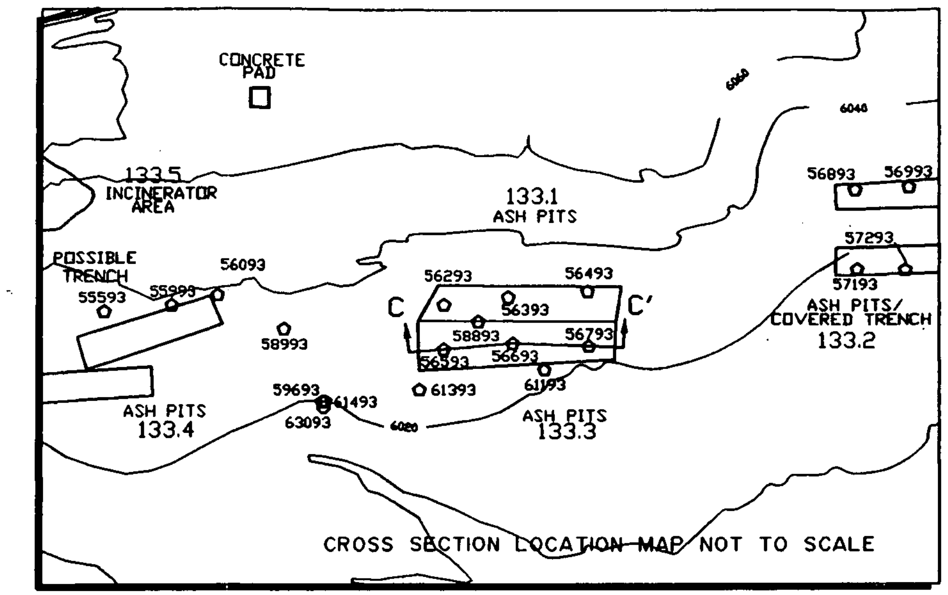
OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.5.3.2-8

2532-7.DWG

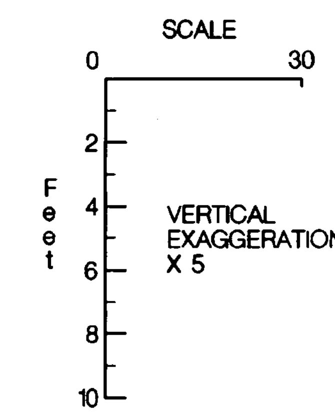




LEGEND

57593 BOREHOLE IDENTIFICATION NUMBER

BEDROCK CONTACT-LINE DASHED WHERE INFERRED



NOTES: NO GROUNDWATER WAS ENCOUNTERED DURING DRILLING OF THESE BOREHOLES

Drawn	5/13/94 Date
Checked	5/13/94 Date
Approved EG&G	Date
Approved DOE	Date

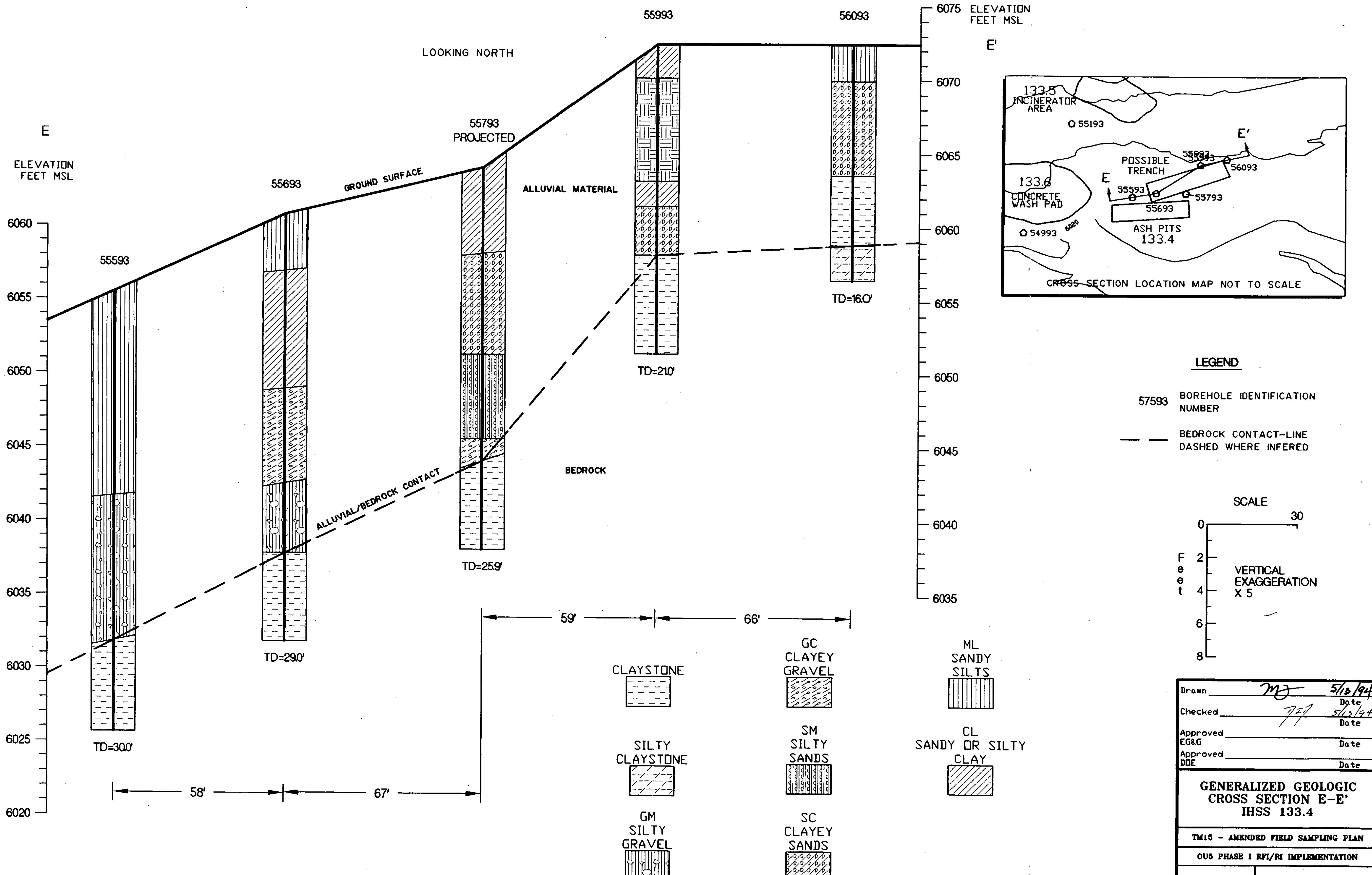
GENERALIZED GEOLOGIC CROSS SECTION C-C' IHSS 133.3

TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G FIGURE 2.5.3.2-9

2532-8



NOTES: NO GROUNDWATER WAS ENCOUNTERED DURING DRILLING OF THESE BOREHOLES

Drawn [signature]	Date 5/13/94
Checked [signature]	Date 5/13/94
Approved EG&G	Date
Approved DOE	Date

GENERALIZED GEOLOGIC CROSS SECTION E-E' IHSS 133.4

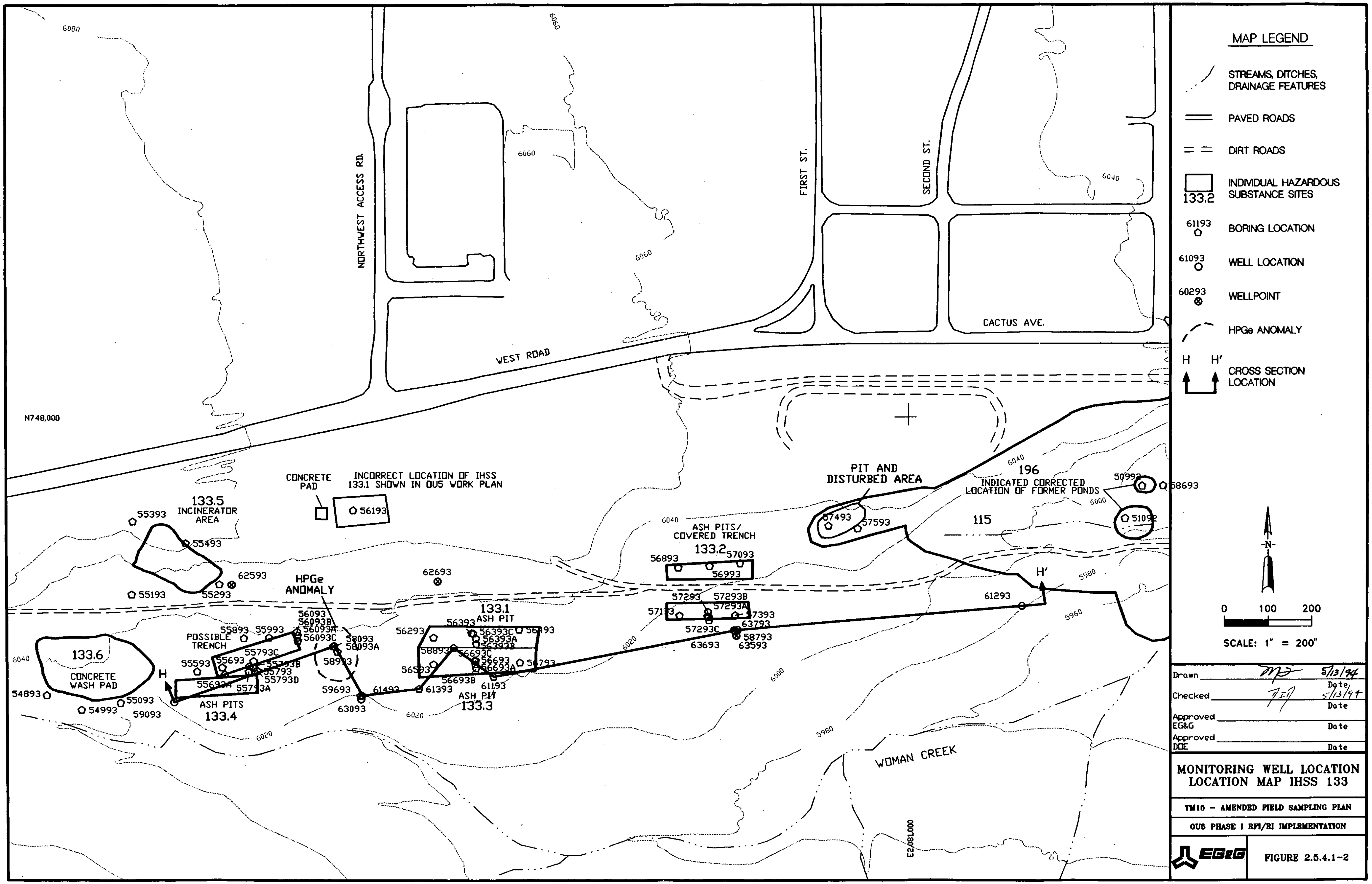
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

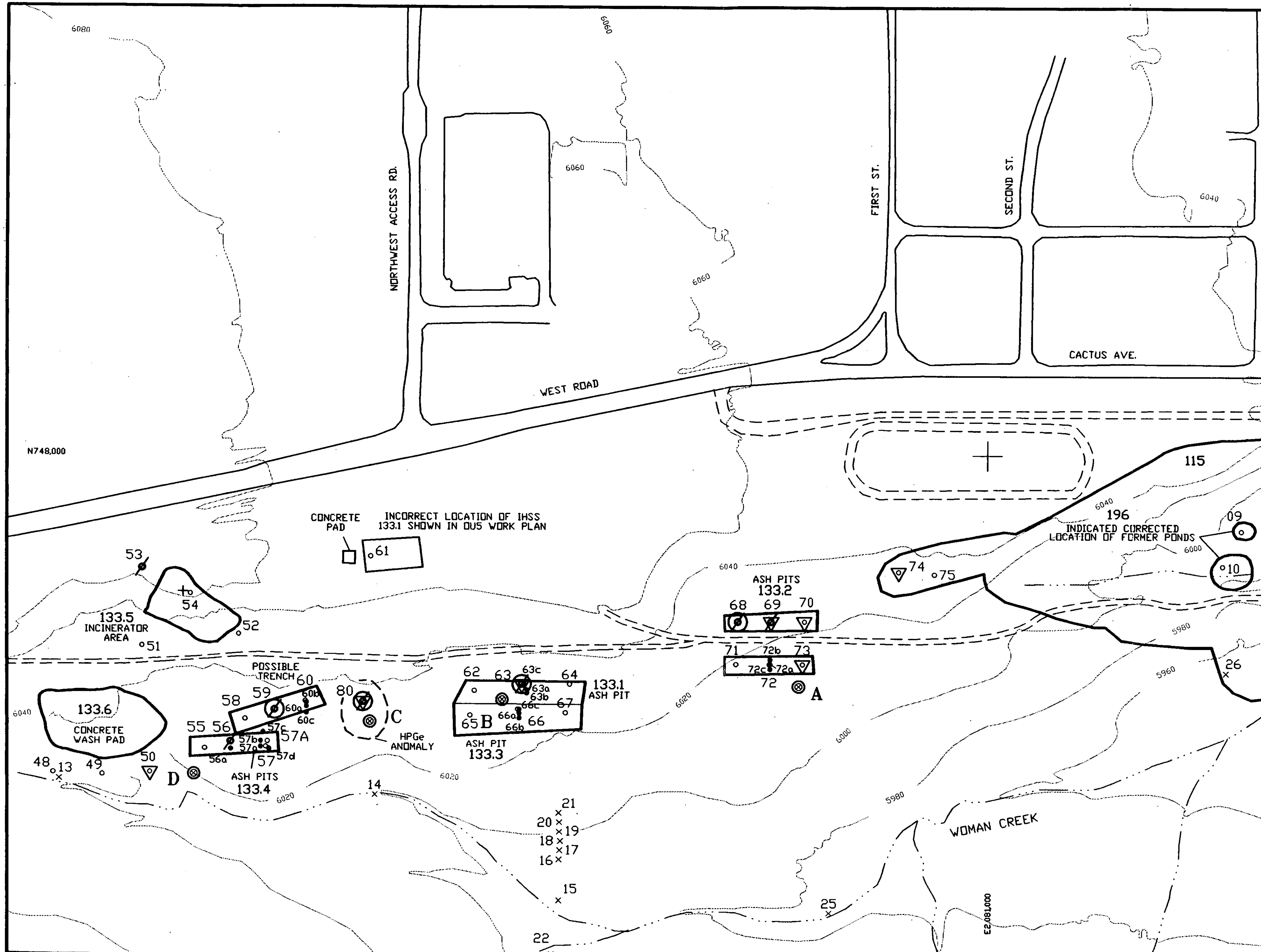
EG&G

FIGURE 2.5.3.2-11

2532-11.DWG



MAP LEGEND
STREAMS, DITCHES, DRAINAGE FEATURES
PAVED ROADS
DIRT ROADS
INDIVIDUAL HAZARDOUS SUBSTANCE SITES
133.2
BORING LOCATION
WELL LOCATION
WELLPOINT
HPGe ANOMALY
CROSS SECTION LOCATION
SCALE: 1" = 200'
NORTHWEST ACCESS RD.
FIRST ST.
SECOND ST.
CACTUS AVE.
WEST ROAD
N748,000
E2,081,000
CONCRETE PAD
INCORRECT LOCATION OF IHSS 133.1 SHOWN IN OU5 WORK PLAN
133.5 INCINERATOR AREA
PIT AND DISTURBED AREA
196
INDICATED CORRECTED LOCATION OF FORMER PONDS
115
ASH PITS/ COVERED TRENCH
133.2
HPGe ANOMALY
133.1 ASH PIT
POSSIBLE TRENCH
133.6 CONCRETE WASH PAD
ASH PITS 133.4
ASH PIT 133.3
WOMAN CREEK
Drawn 5/13/94
Checked 5/13/94
Approved EG&G
Approved DOE
MONITORING WELL LOCATION LOCATION MAP IHSS 133
TM15 - AMENDED FIELD SAMPLING PLAN
OU5 PHASE I RFI/RI IMPLEMENTATION
EG&G
FIGURE 2.5.4.1-2
2541-2.DWG



Drawn	N.M. 5/11/94 Date
Checked	5/11/94 Date
Approved EG&G	Date
Approved DOE	Date

PROPOSED MONITORING WELL LOCATION MAP IHSS 133

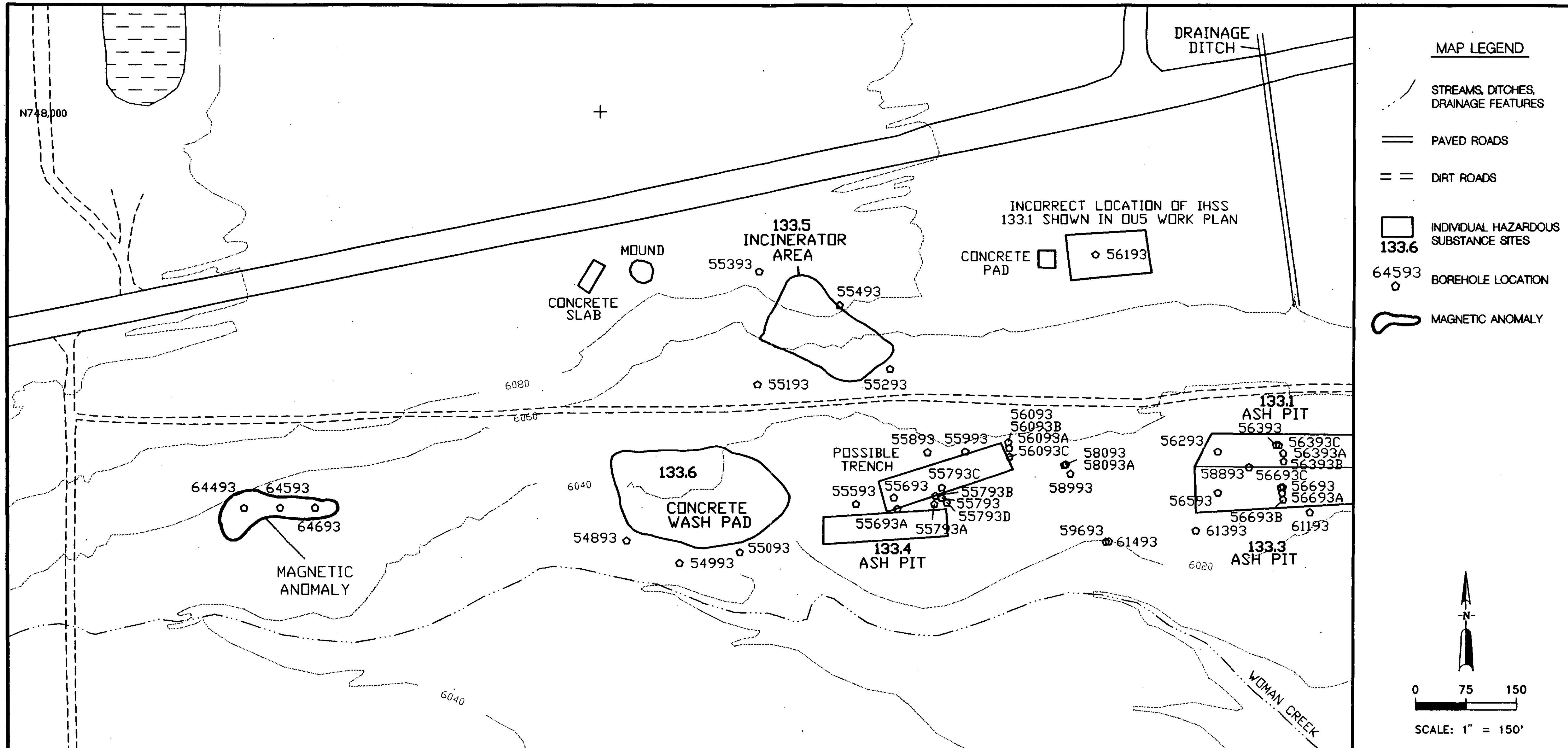
TM15 - AMMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.5.4.1-1

2541-1.DWG



Drawn N.M. 5/11/94 Date
Checked 5/11/94 Date
Approved EG&G Date
Approved DOE Date

MAGNETIC ANAMOLY AND BOREHOLE LOCATION MAP WEST OF IHSS 133

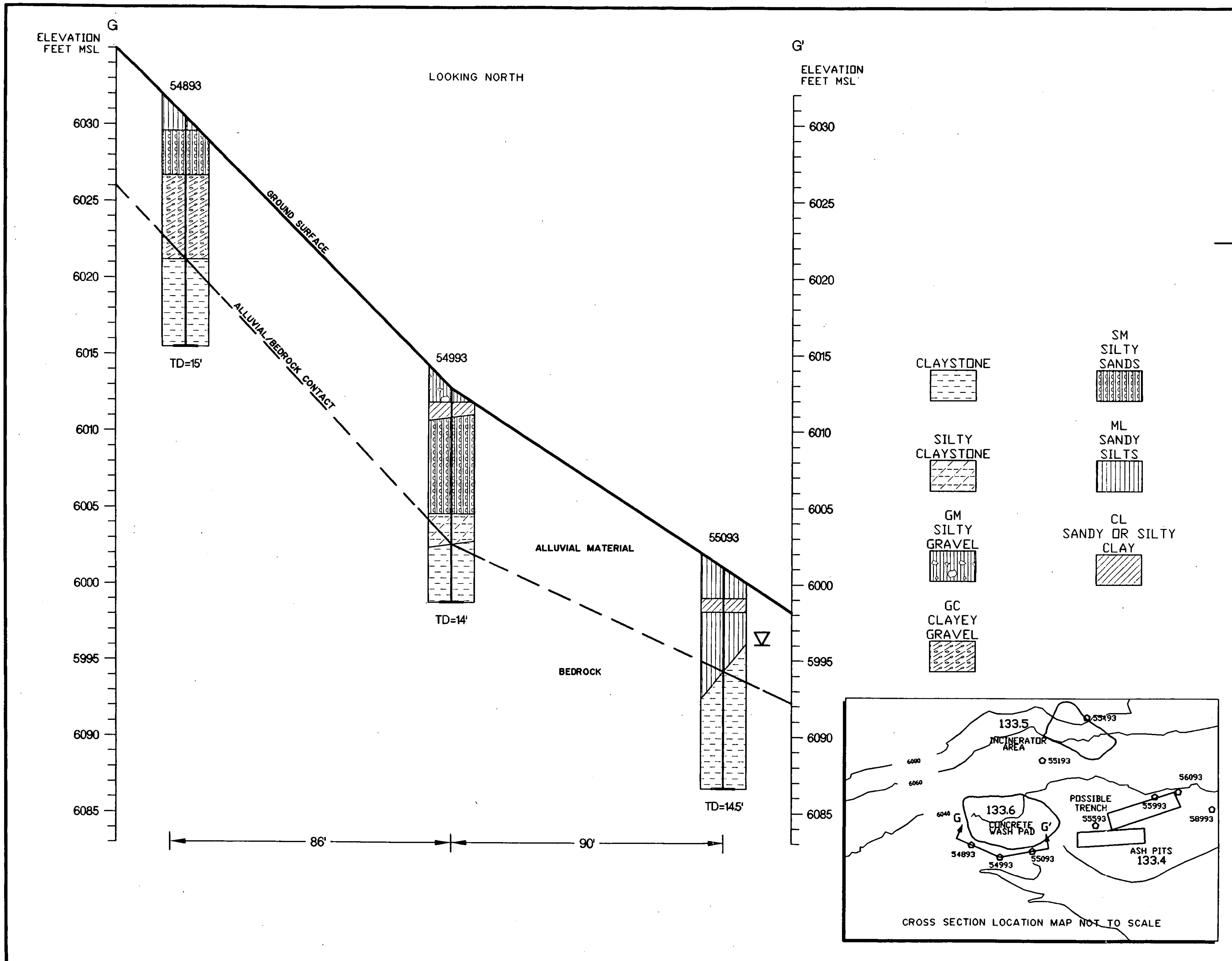
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.5.3.3-1

2533-1.DWG



Drawn	5/8/94
	Date
Checked	5/13/94
	Date
Approved EG&G	Date
Approved DOE	Date

GENERALIZED GEOLOGIC CROSS SECTION G–G' IHSS 133.6

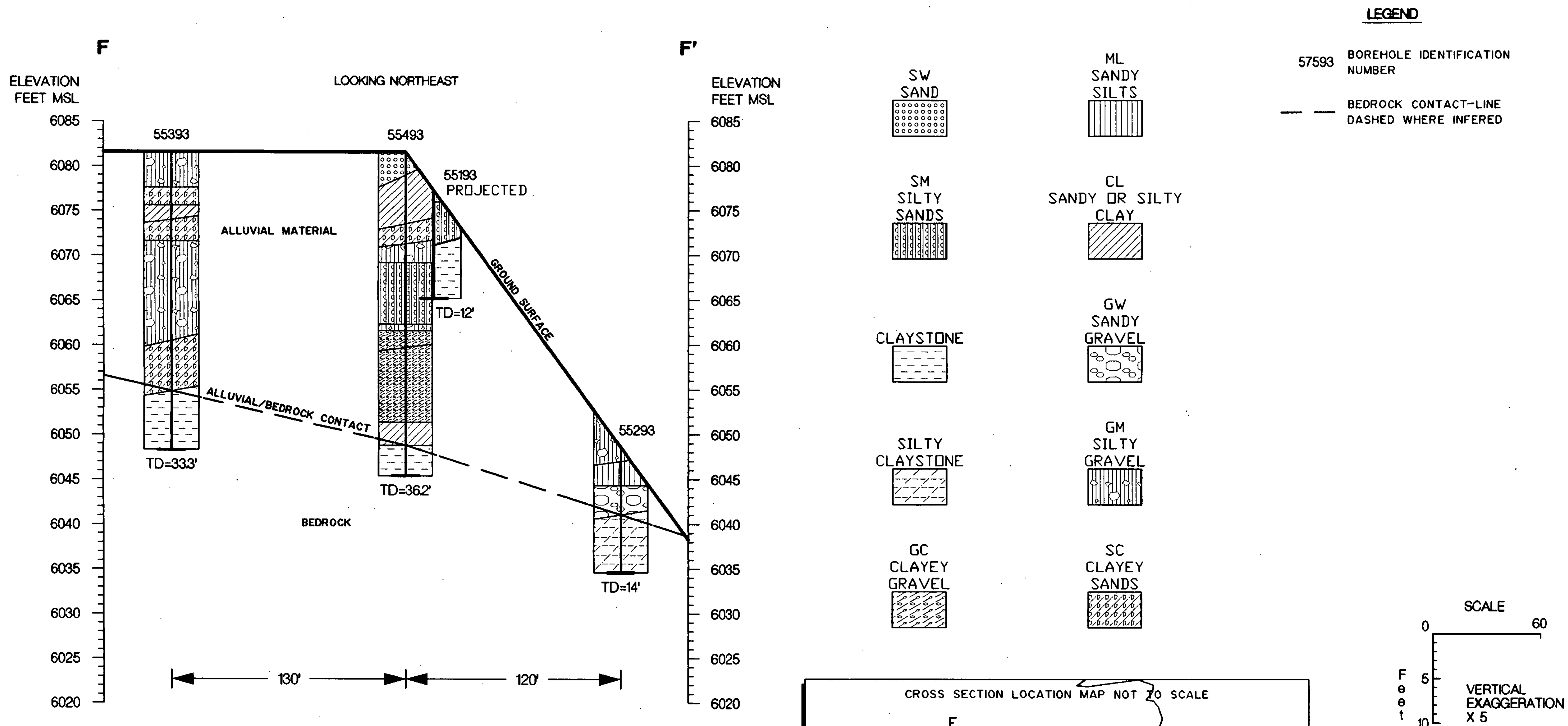
TM15 – AMENDED FIELD SAMPLING PLAN

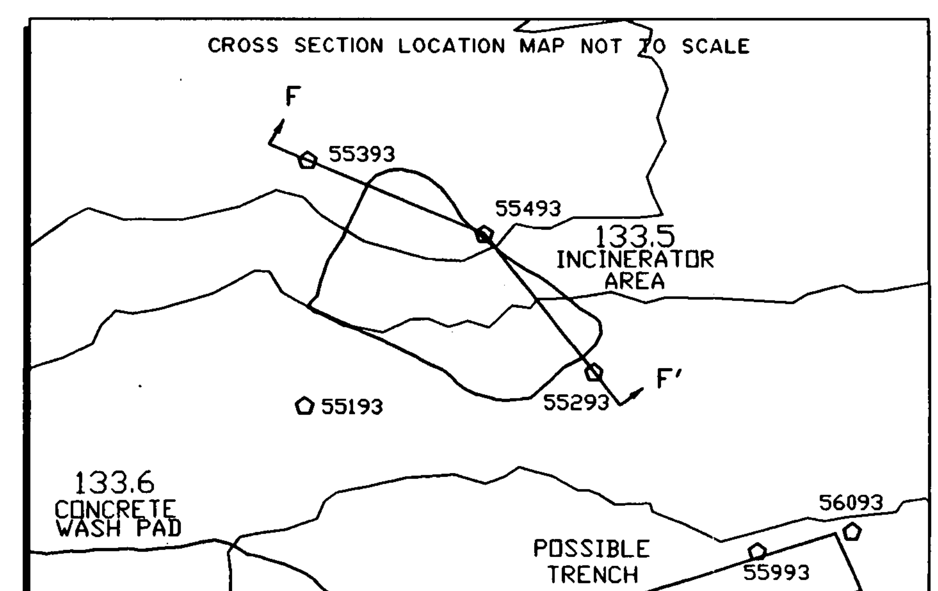
OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.5.3.2–13

2632-13DWG





NOTES: NO GROUNDWATER WAS ENCOUNTERED DURING DRILLING OF THESE BOREHOLES

Drawn	NJ 5/13/94 Date
Checked	TJ 5/13/94 Date
Approved EG&G	Date
Approved DOE	Date

GENERALIZED GEOLOGIC CROSS SECTION F-F' IHSS 133.5

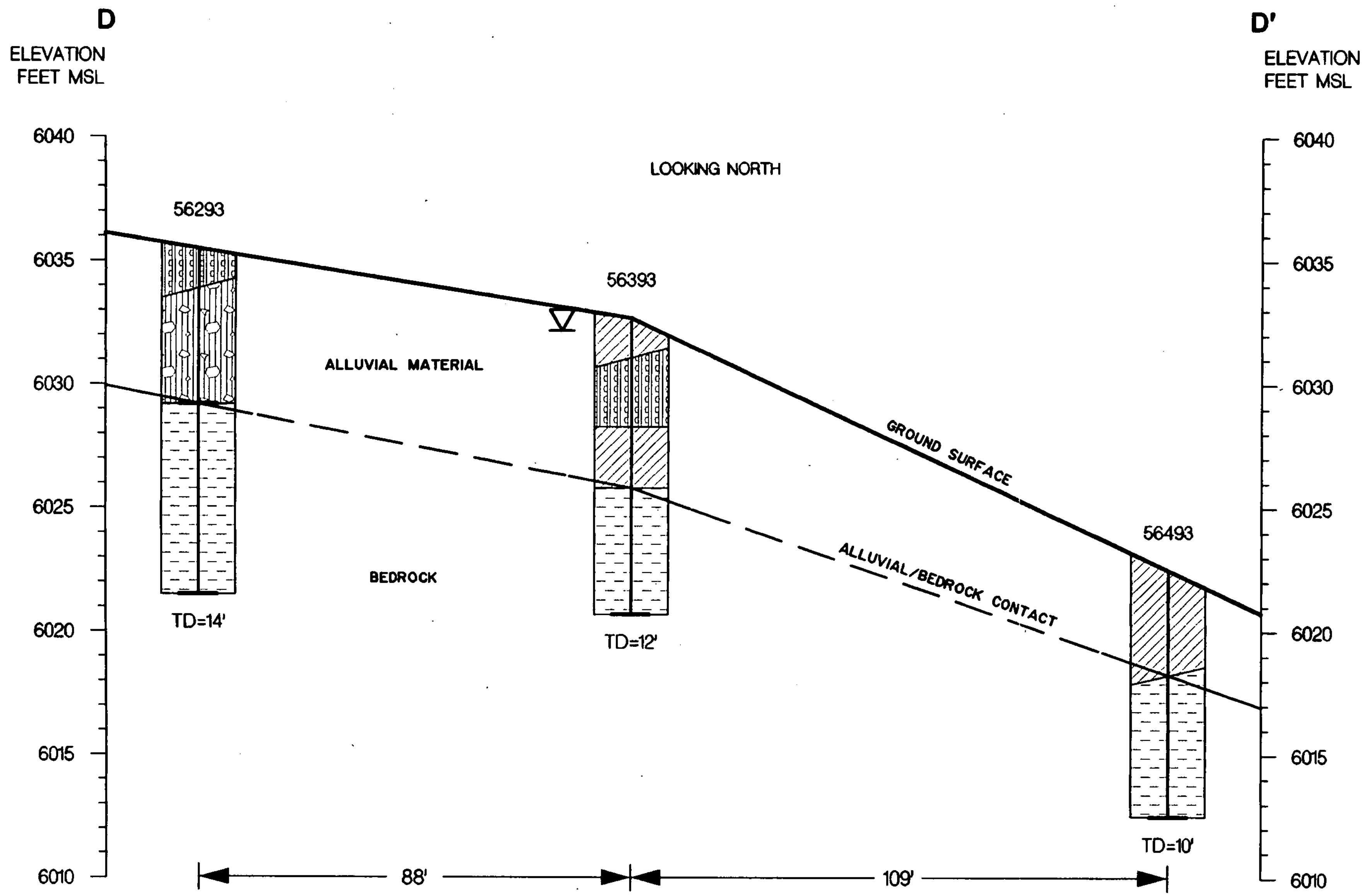
TM15 – AMENDED FIELD SAMPLING PLAN

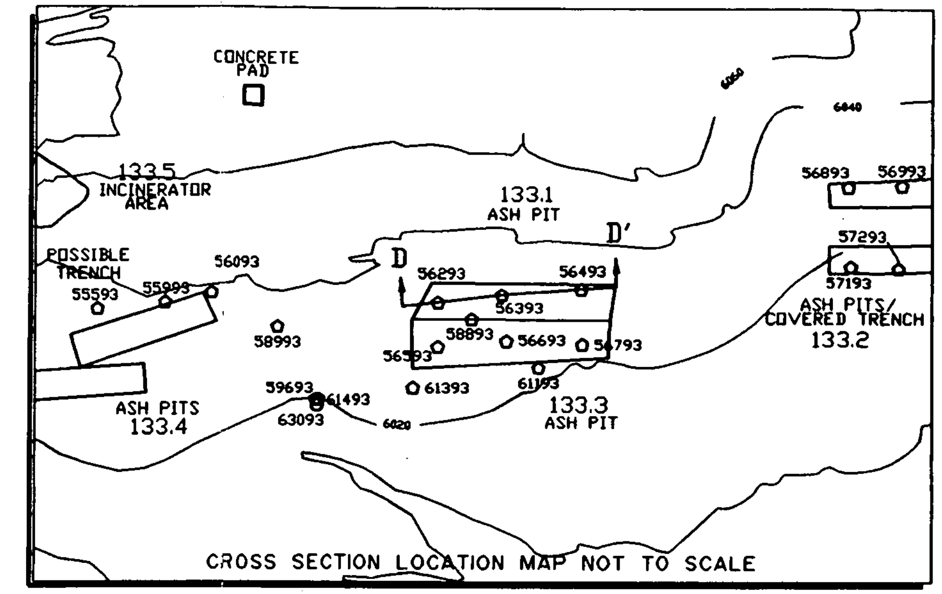
OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.5.3.2-12

2532-12DWG



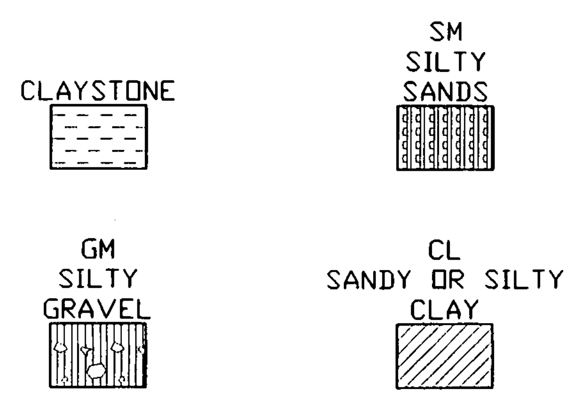


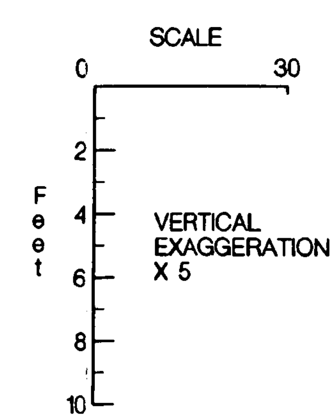
LEGEND

57593 BOREHOLE IDENTIFICATION NUMBER

▽ GROUNDWATER ENCOUNTERED DURING DRILLING

— — BEDROCK CONTACT-LINE DASHED WHERE INFERRED





Drawn	5/13/94 Date
Checked	5/13/94 Date
Approved EG&G	Date
Approved DOE	Date

GENERALIZED GEOLOGIC CROSS SECTION D-D' IHSS 133.1

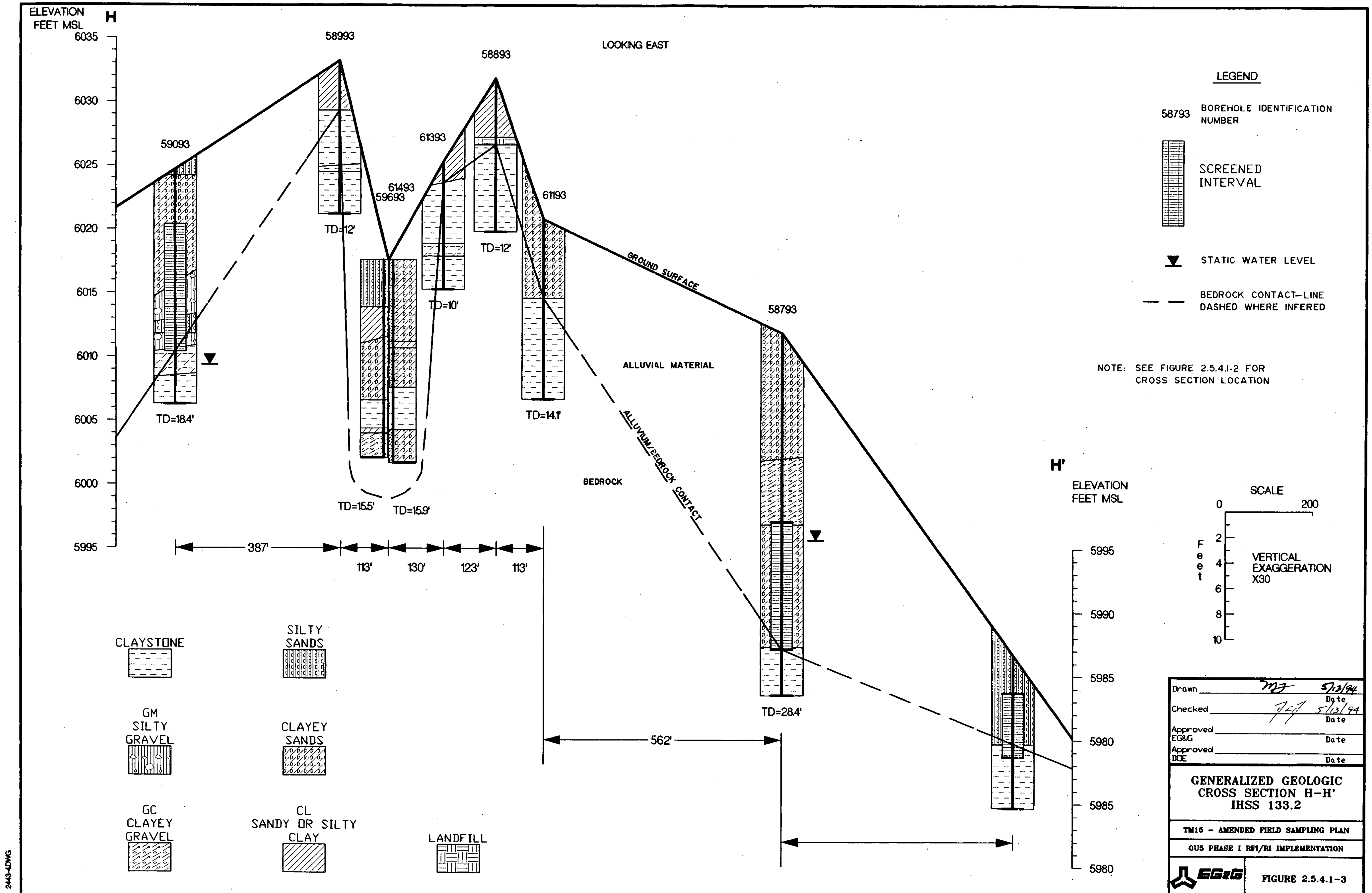
TM15 - AMENDED FIELD SAMPLING PLAN

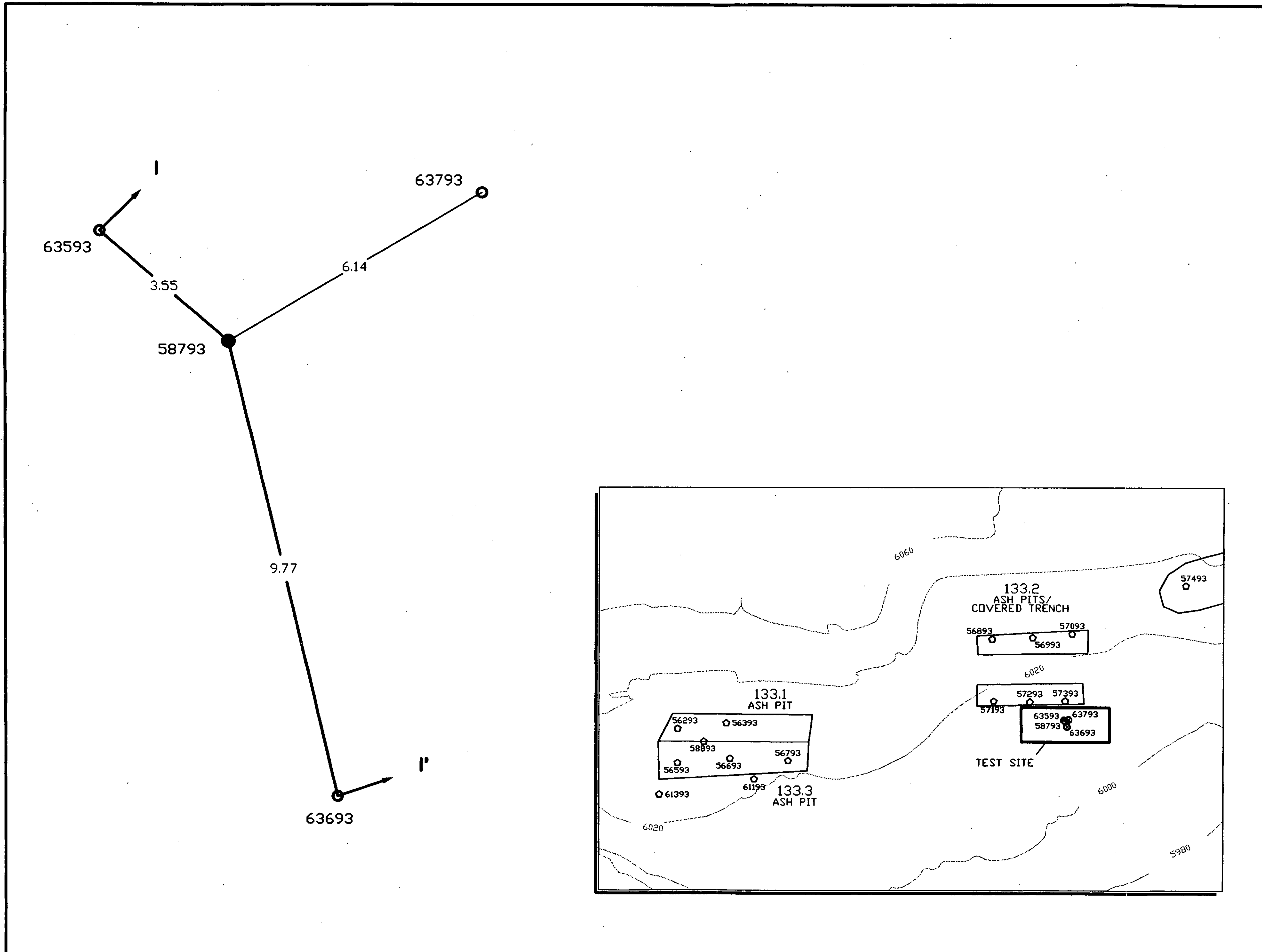
OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.5.3.2-10

2532-10


ELEVATION FEET MSL
H
LOOKING EAST
59093
58993
58893
61393
61493
59693
61193
58793
TD=18.4'
TD=12'
TD=10'
TD=12'
TD=14.1'
TD=15.5'
TD=15.9'
TD=28.4'
GROUND SURFACE
ALLUVIAL MATERIAL
ALLUVIUM/BEDROCK CONTACT
BEDROCK
387'
113'
130'
123'
113'
562'
H'
ELEVATION FEET MSL
LEGEND
58793 BOREHOLE IDENTIFICATION NUMBER
SCREENED INTERVAL
STATIC WATER LEVEL
BEDROCK CONTACT-LINE DASHED WHERE INFERED
NOTE: SEE FIGURE 2.5.4.1-2 FOR CROSS SECTION LOCATION
SCALE
0
200
Feet
VERTICAL EXAGGERATION X30
CLAYSTONE
SILTY SANDS
GM SILTY GRAVEL
CLAYEY SANDS
GC CLAYEY GRAVEL
CL SANDY OR SILTY CLAY
LANDFILL
Drawn 5/13/94 Date
Checked 5/13/94 Date
Approved EG&G Date
Approved DOE Date
GENERALIZED GEOLOGIC CROSS SECTION H-H' IHSS 133.2
TM15 - AMENDED FIELD SAMPLING PLAN
OU5 PHASE I RFI/RI IMPLEMENTATION
EG&G
FIGURE 2.5.4.1-3
2443-4DWG



MAP LEGEND

PAVED ROADS

133.1 INDIVIDUAL HAZARDOUS SUBSTANCE SITES

51193 PUMPING WELL

63393 OBSERVATION WELL

I I' CROSS SECTION LOCATION

N

0 1 2

SCALE: 1" = 2'

Drawn	N.M.	5/13/94 Date
Checked		5/13/94 Date
Approved EG&G		Date
Approved DOE		Date

AQUIFER PUMPING TEST SITE LOCATION MAP IHSS 133

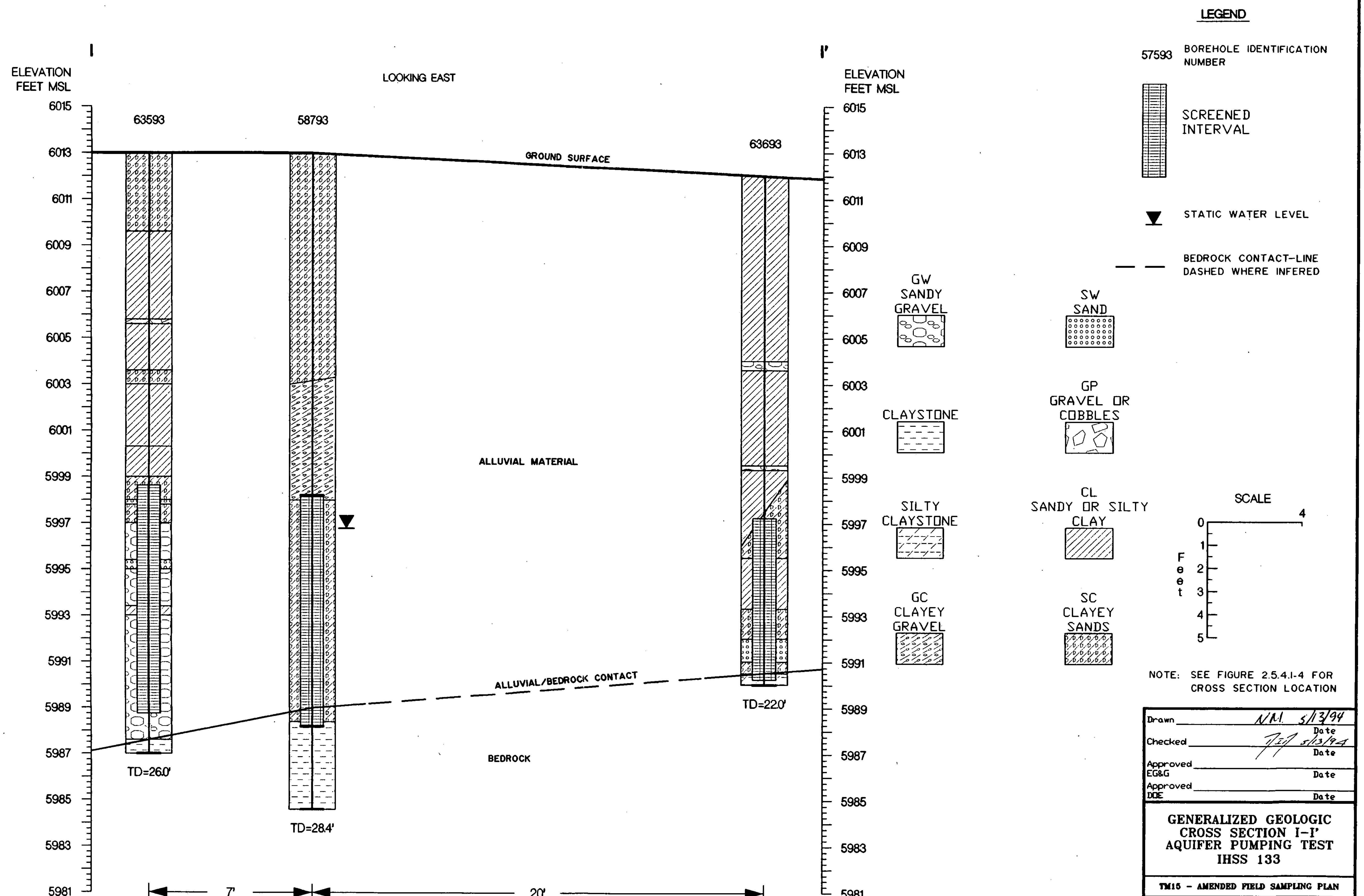
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.5.4.1-4

2541-4.DWG



Drawn NM	5/13/94 Date
Checked	5/13/94 Date
Approved EG&G	Date
Approved DOE	Date

GENERALIZED GEOLOGIC CROSS SECTION I-I' AQUIFER PUMPING TEST IHSS 133

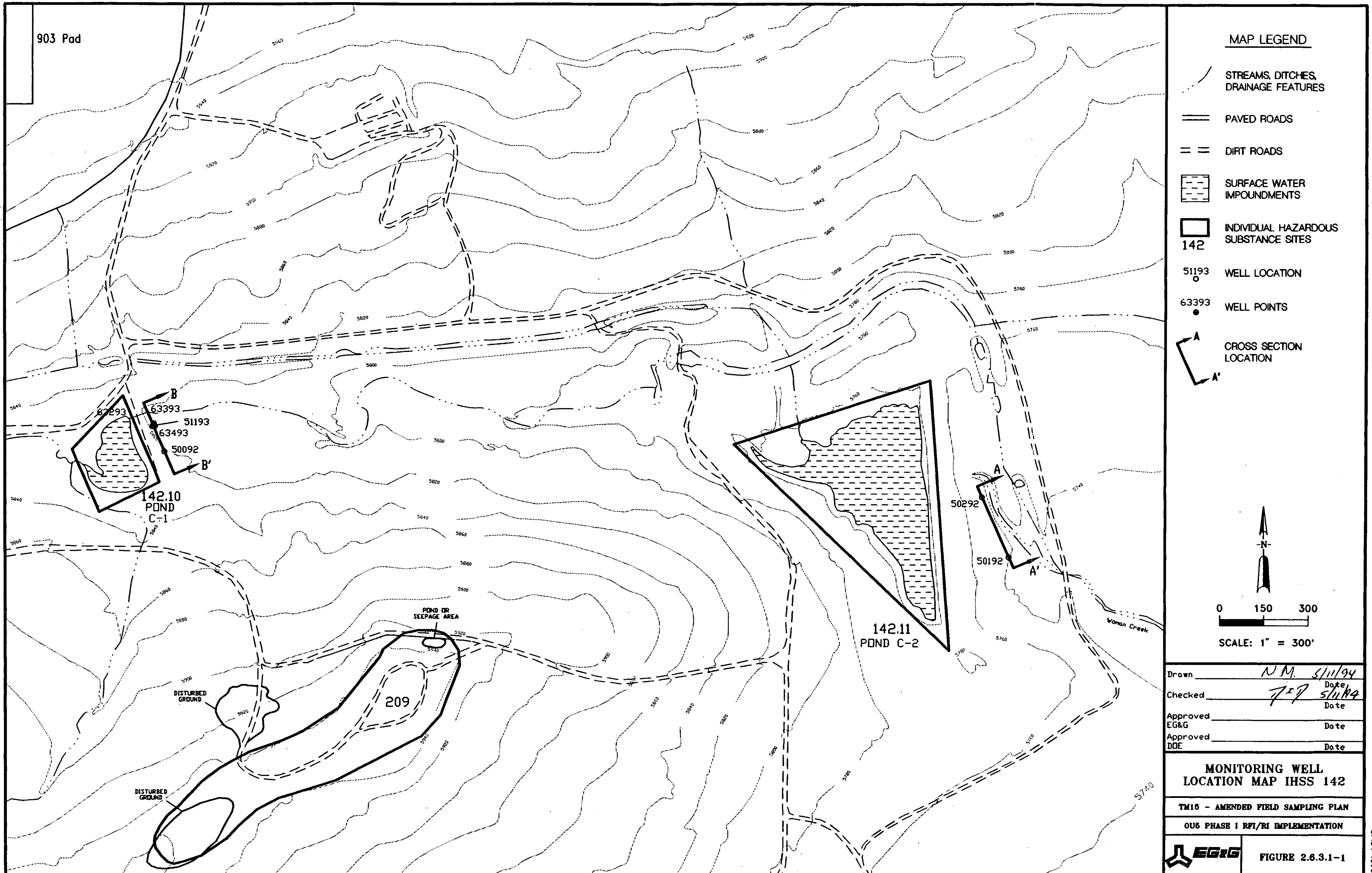
TM15 - AMENDED FIELD SAMPLING PLAN

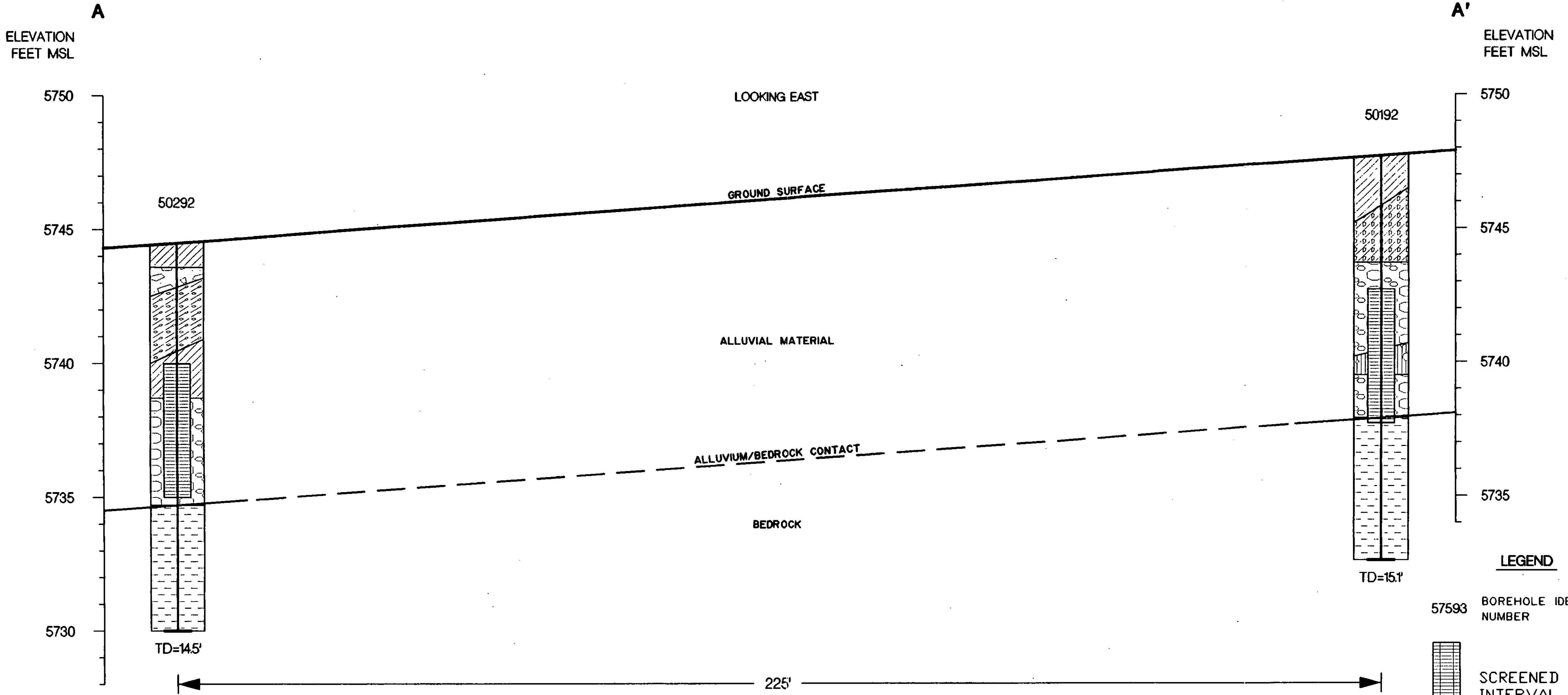
OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.5.4.1-5

254-1-6.DWG


903 Pad
MAP LEGEND
STREAMS, DITCHES, DRAINAGE FEATURES
PAVED ROADS
DIRT ROADS
SURFACE WATER IMPOUNDMENTS
INDIVIDUAL HAZARDOUS SUBSTANCE SITES
142
51193
WELL LOCATION
63393
WELL POINTS
A
A'
CROSS SECTION LOCATION
N
0
150
300
SCALE: 1" = 300'
B
B'
67293
63393
51193
63493
50092
142.10
POND
C-1
142.11
POND C-2
50292
50192
POND OR SEEPAGE AREA
DISTURBED GROUND
209
DISTURBED GROUND
Woman Creek
5740
Drawn N.M. 5/11/94 Date
Checked 5/11/94 Date
Approved EG&G Date
Approved DOE Date
MONITORING WELL LOCATION MAP IHSS 142
TM15 - AMENDED FIELD SAMPLING PLAN
OU5 PHASE I RFI/RI IMPLEMENTATION
EG&G
FIGURE 2.6.3.1-1
2631-1.DWG

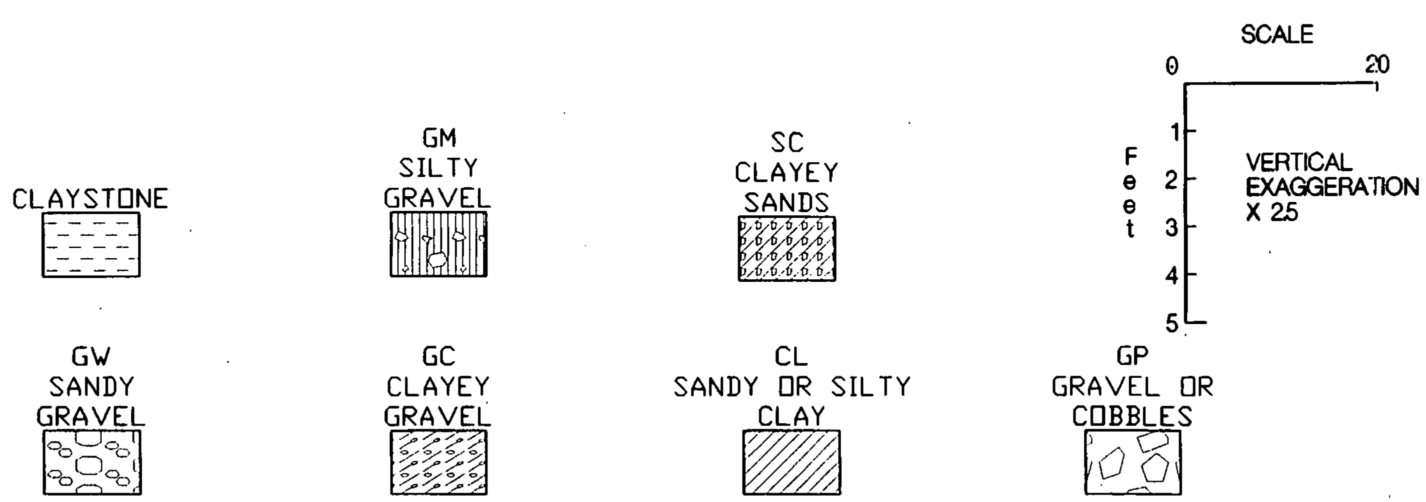


LEGEND

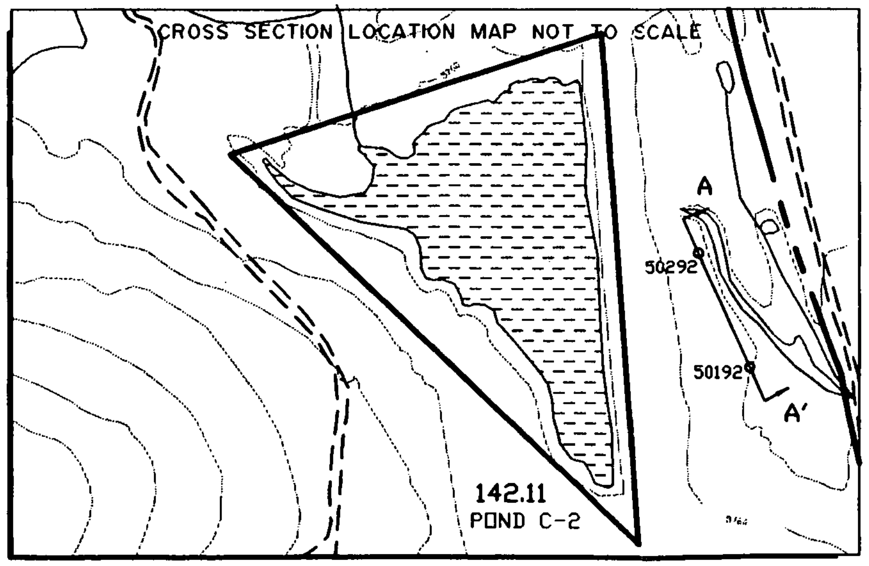
57593 BOREHOLE IDENTIFICATION NUMBER

SCREENED INTERVAL

BEDROCK CONTACT-LINE DASHED WHERE INFERED



NOTE: No water levels are on record for these wells



Drawn	5/13/94 Date
Checked	5/13/94 Date
Approved EG&G	Date
Approved DOE	Date

GENERALIZED GEOLOGIC CROSS SECTION A-A' IHSS 142

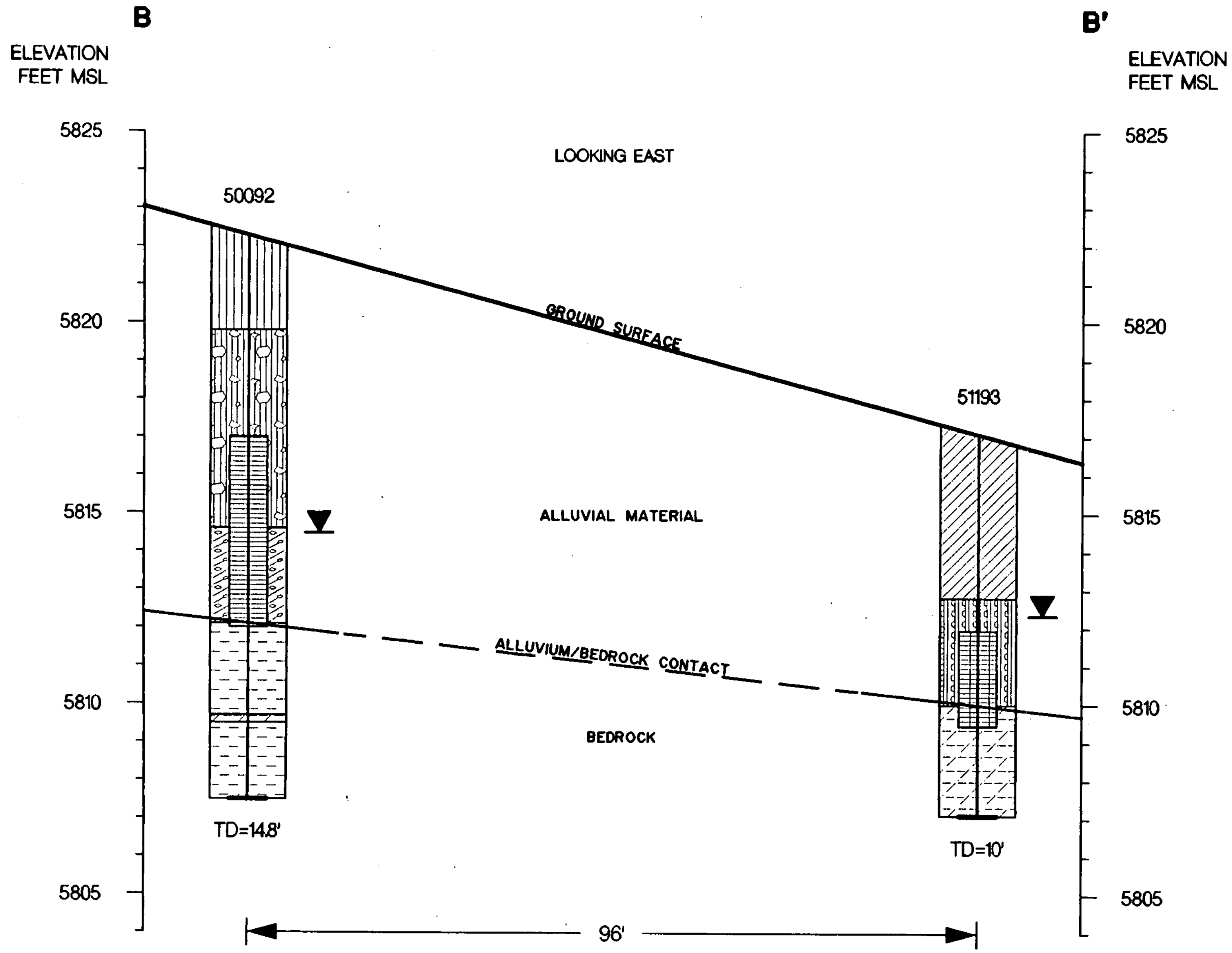
TM15 - AMENDED FIELD SAMPLING PLAN

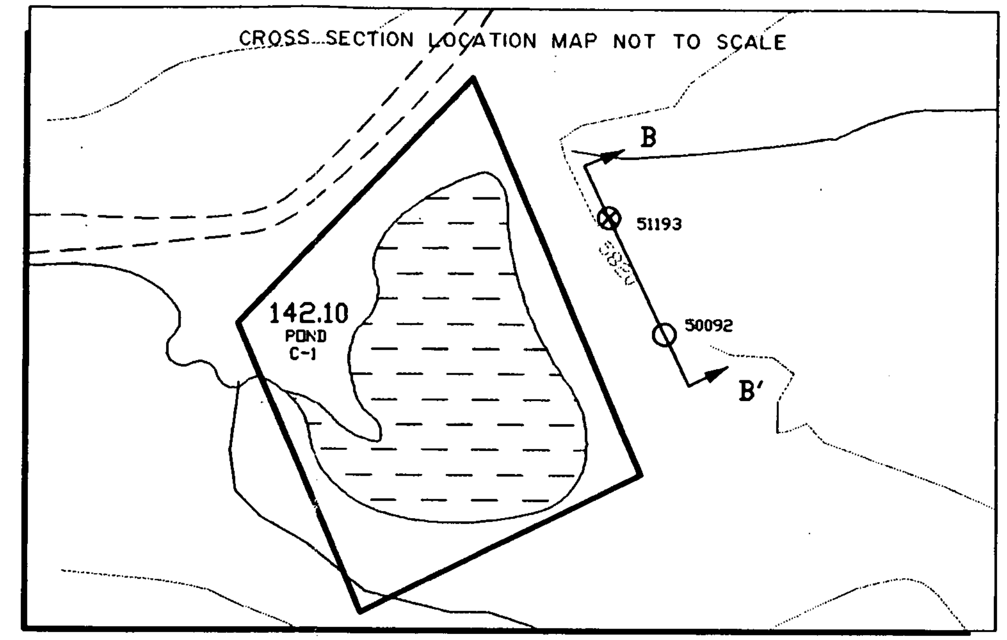
OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.6.3.1-2

2631-2DWG





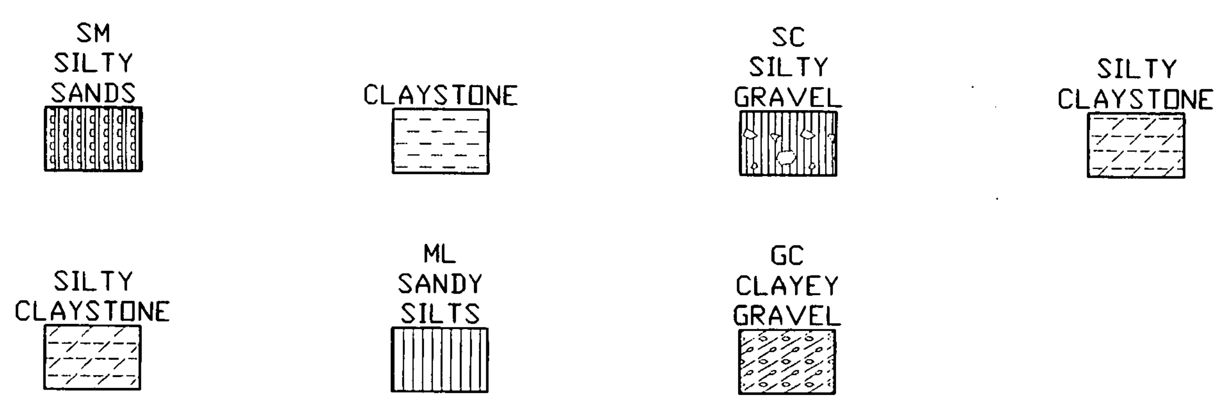
LEGEND

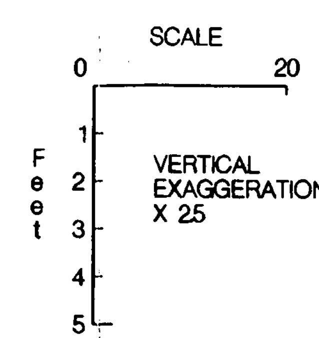
57593 BOREHOLE IDENTIFICATION NUMBER

SCREENED INTERVAL

STATIC WATER LEVEL

BEDROCK CONTACT-LINE DASHED WHERE INFERED





Drawn	N.M	5/13/94 Date
Checked	[illegible]	5/13/94 Date
Approved EG&G		Date
Approved DOE		Date

GENERALIZED GEOLOGIC CROSS SECTION B-B' IHSS 142

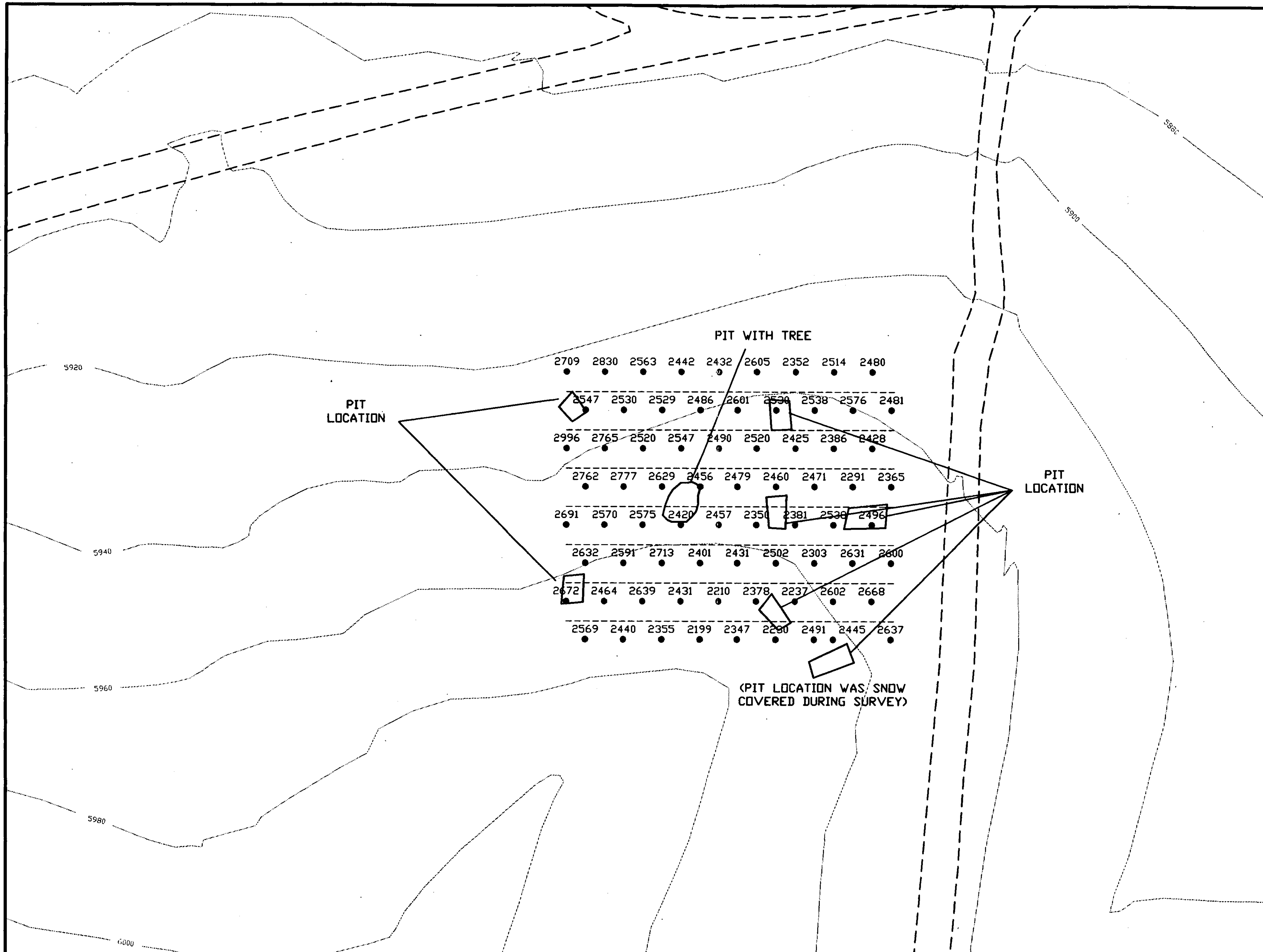
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.6.3.1-3

2631-3.DWG



MAP LEGEND

- = = DIRT ROADS
- ◇ PIT LOCATIONS/ FORMER EXCAVATIONS
- 2480 ● 1 - MINUTE SCALER READING LOCATION (COUNTS PER MINUTE)
- - - - CONTINUOUS SURVEY LINE

BACKGROUND READING FOR SURVEY WAS 2576 cpm

-N-

0 50 100

SCALE: 1" = 100'

Drawn	N.M. 5/11/94 Date
Checked	5/11/94 Date
Approved EG&G	Date
Approved DOE	Date

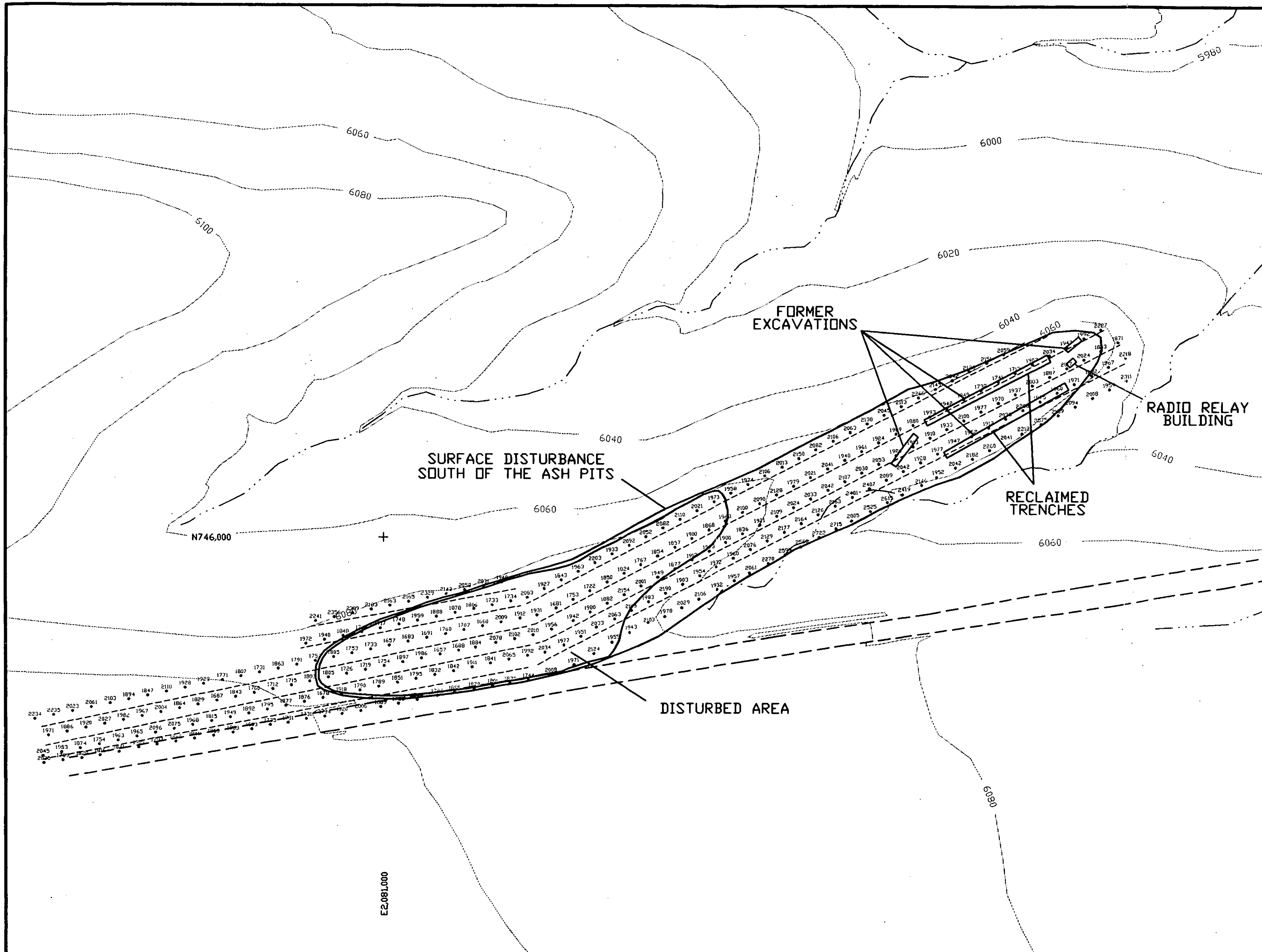
FIDLER SURVEY RESULTS SURFACE DISTURBANCE WEST OF IHSS 209

TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G FIGURE 2.7.2.2-2

2722-2.DWG



MAP LEGEND

STREAMS, DITCHES, DRAINAGE FEATURES

DIRT ROADS

REVISED PIT LOCATIONS/ FORMER EXCAVATIONS

1 - MINUTE SCALER READING LOCATION (COUNTS PER MINUTE)

CONTINUOUS SURVEY LINE

BACKGROUND READINGS FROM FOR SURVEY RANGED FROM 1730 cpm TO 2031 cpm

-N-

0 100 200

SCALE: 1" = 200'

Drawn	N.M.	5/11/94
Checked	[illegible]	Date 5/11/94
		Date
Approved EG&G		Date
Approved DOE		Date

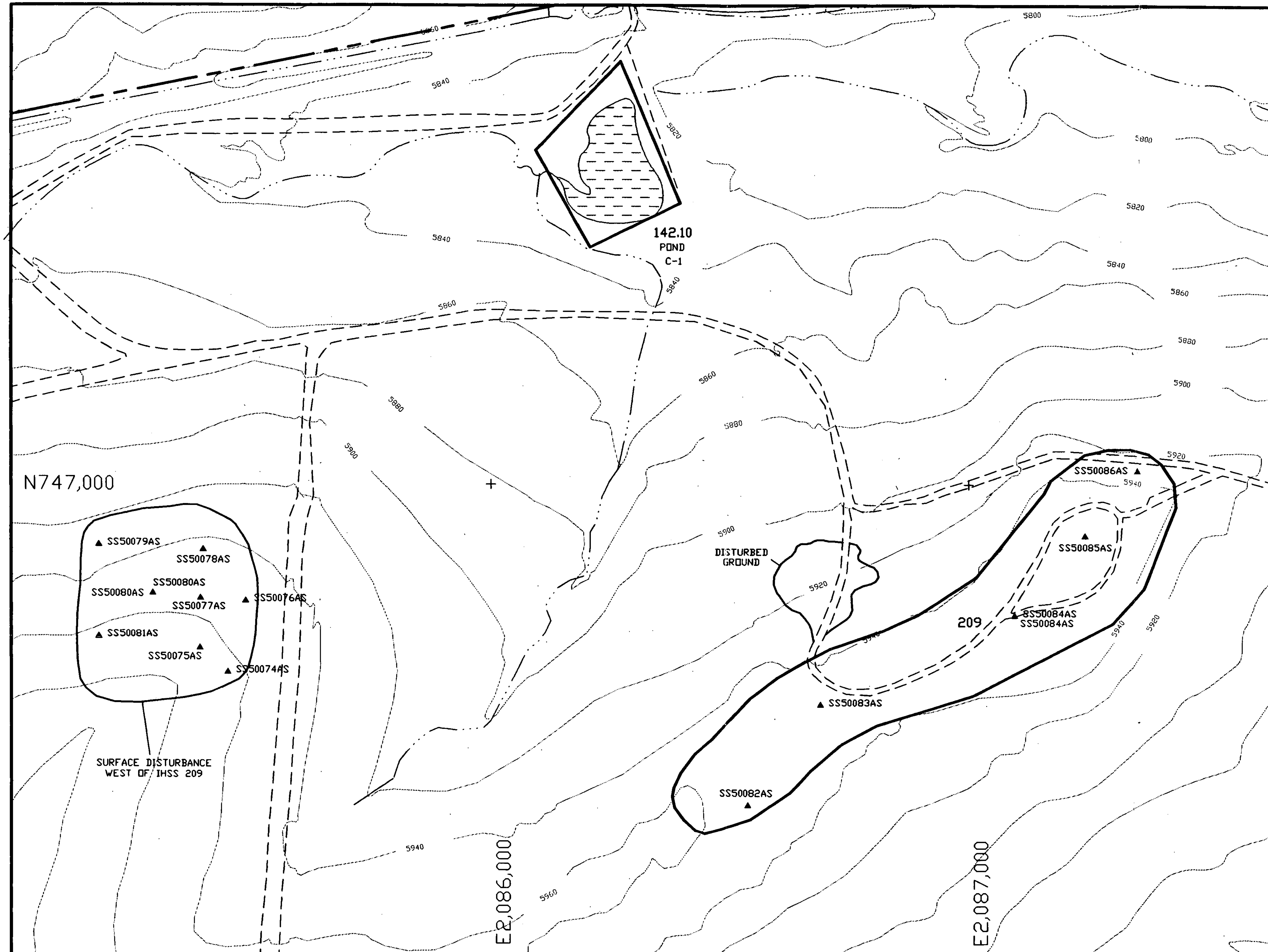
FIDLER SURVEY RESULTS SURFACE DISTURBANCE SOUTH OF THE ASH PITS

TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G FIGURE 2.7.2.2-3

2722-3.DWG



MAP LEGEND

STREAMS, DITCHES, DRAINAGE FEATURES

DIRT ROADS

209 INDIVIDUAL HAZARDOUS SUBSTANCE SITES (IHSS)

SS50082AS SURFACE SOIL SAMPLE LOCATIONS

N

0 100 200

SCALE: 1" = 200'

Drawn	N.M.	5/11/94 Date
Checked	TJF	5/11/94 Date
Approved EG&G		Date
Approved DOE		Date

SURFACE SOIL SAMPLE LOCATIONS IHSS 209 AND SURFACE DISTURBANCE WEST OF IHSS 209

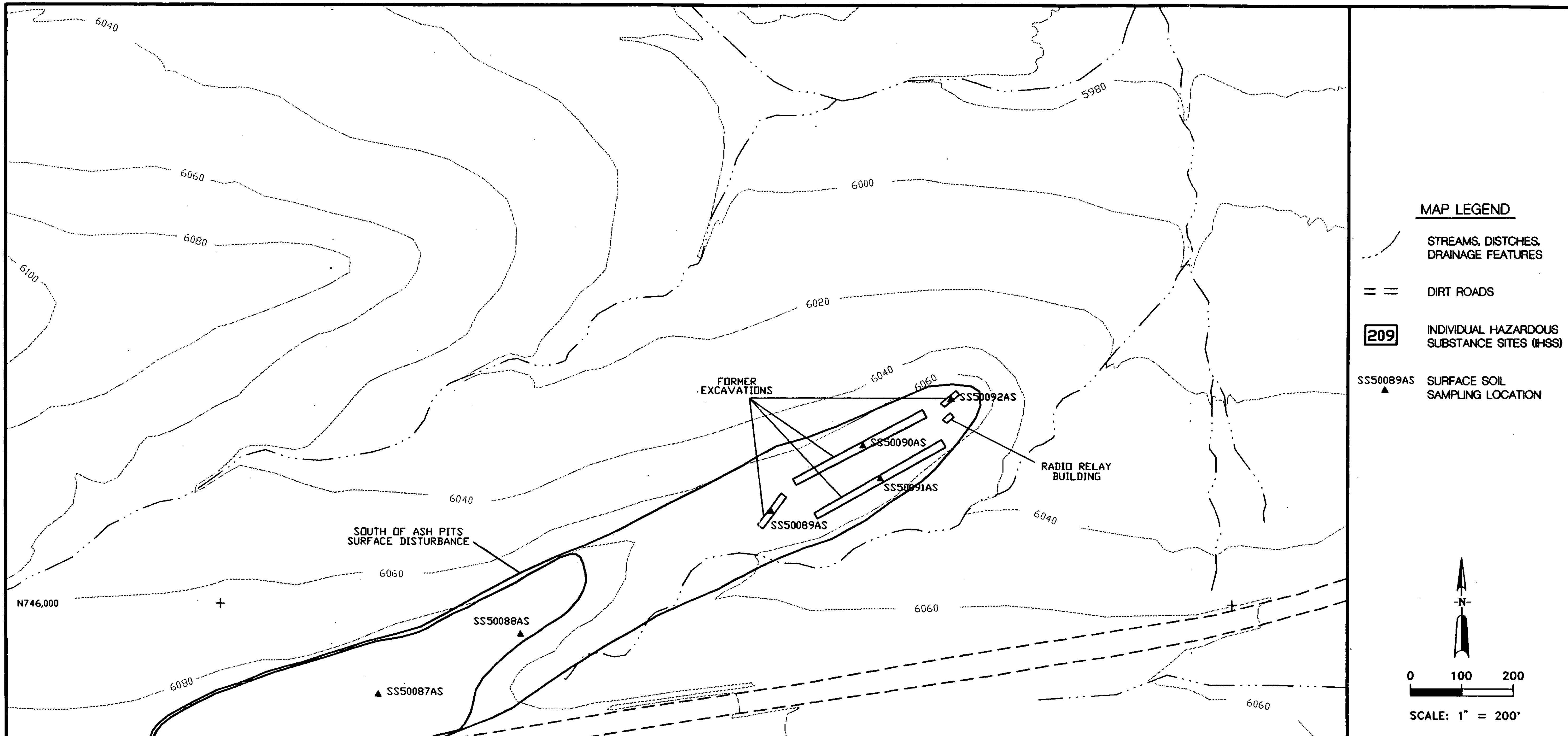
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.7.3.2-1A

2732-A.DWG



Drawn NM Date 5/11/94

Checked Date 5/11/94

Approved EG&G Date

Approved DOE Date

SURFACE SOIL SAMPLE LOCATIONS SURFACE DISTURBANCE SOUTH OF THE ASH PITS

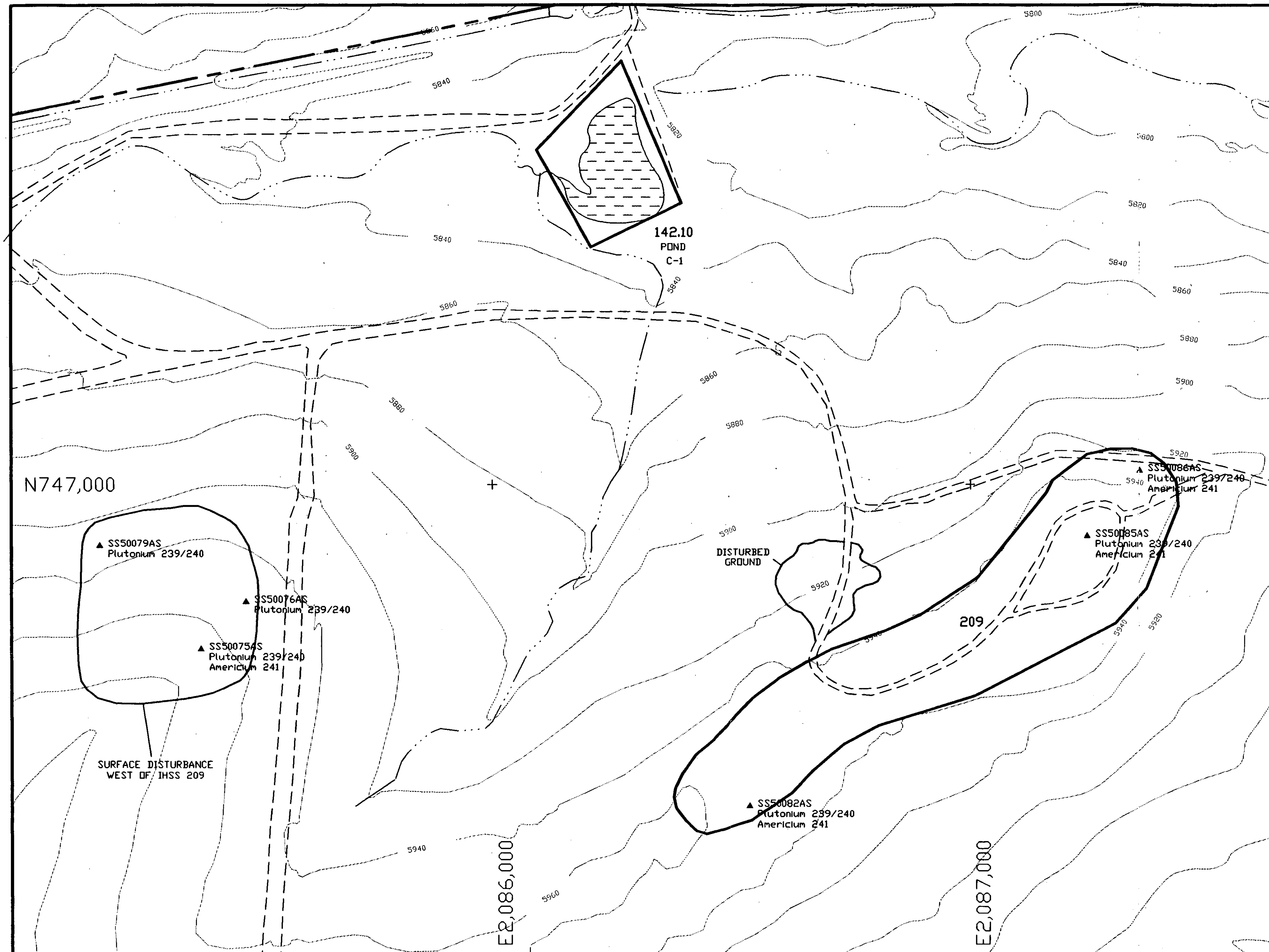
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.7.3.2-1B

2732-B.DWG



Drawn N.M. 5/11/94 Date

Checked [illegible] 5/11/94 Date

Approved EG&G Date

Approved DOE Date

SURFACE SOIL SAMPLES WITH RADIONUCLIDES GREATER THAN THE BUTL's IHSS 209 AND SURFACE DISTURBANCE WEST OF IHSS 209

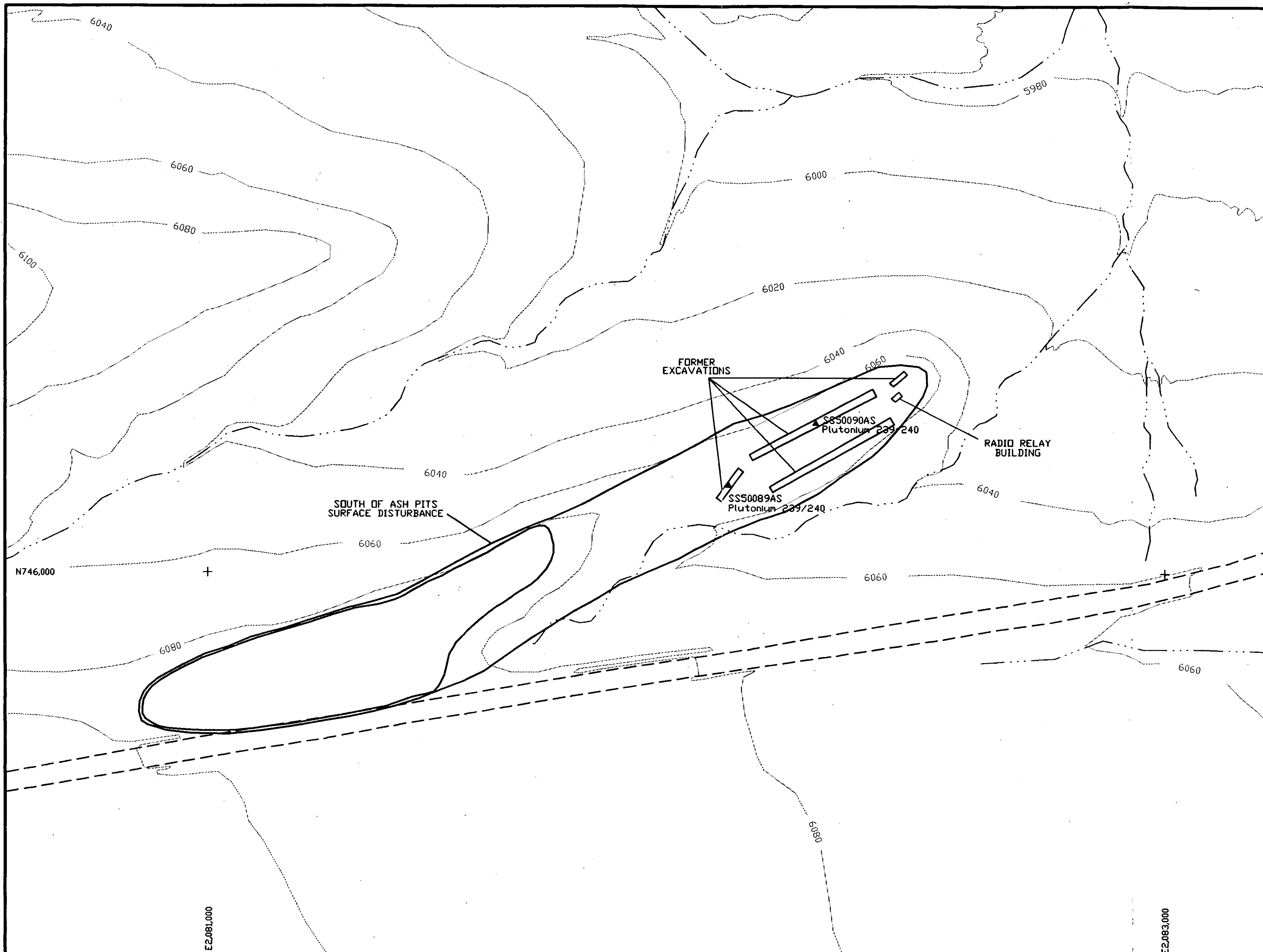
TM15 - AMENDED FIELD SAMPLING PLAN

OU6 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.7.3.2-2A

2732-A.DWG



Drawn N.M.	5/11/94 Date
Checked	5/11/94 Date
Approved EG&G	Date
Approved DOE	Date

SURFACE SOIL SAMPLES WITH RADIONUCLIDES GREATER THAN THE BUTL's SURFACE DISTURBANCE SOUTH OF THE ASH PITS

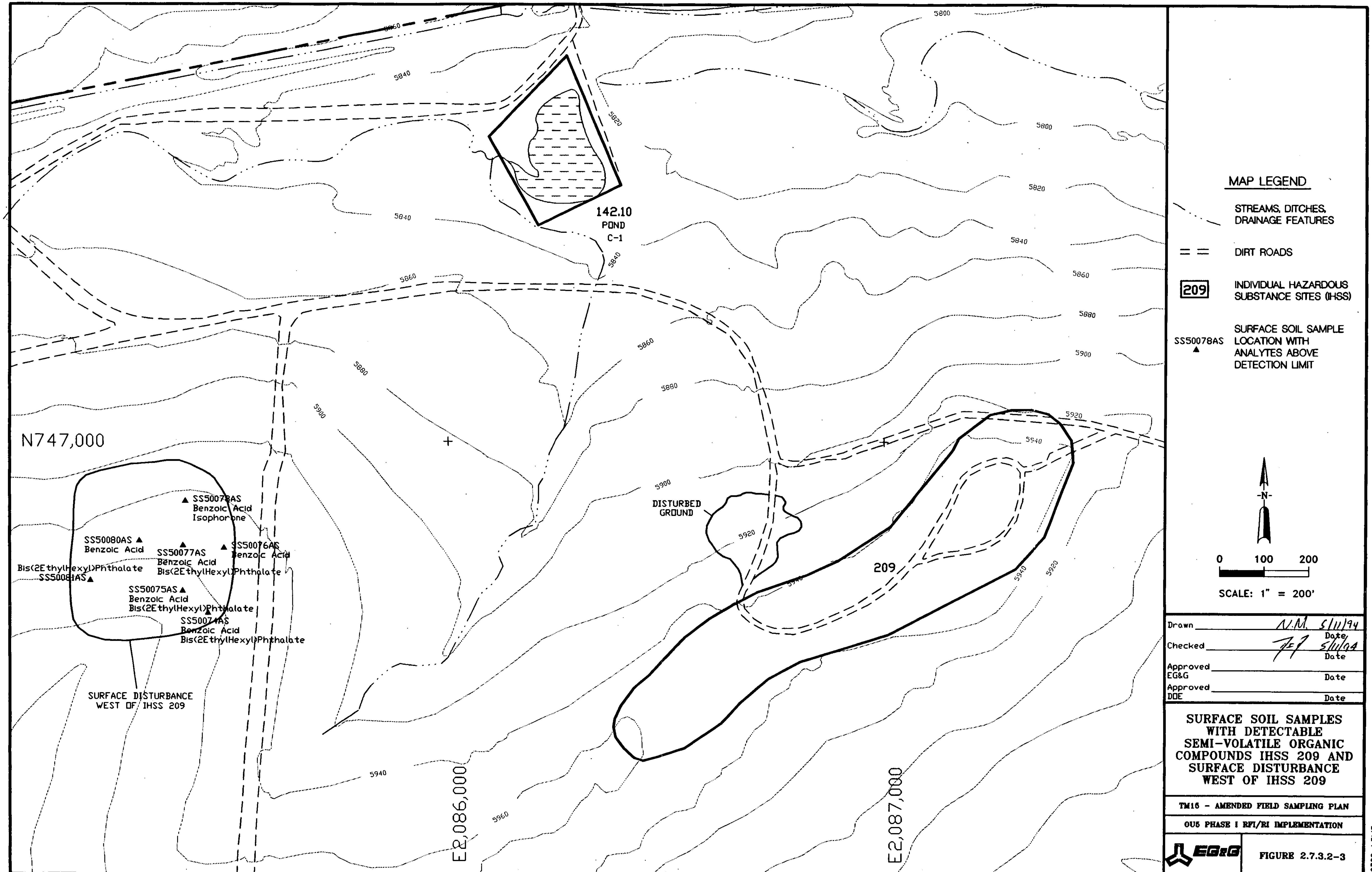
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

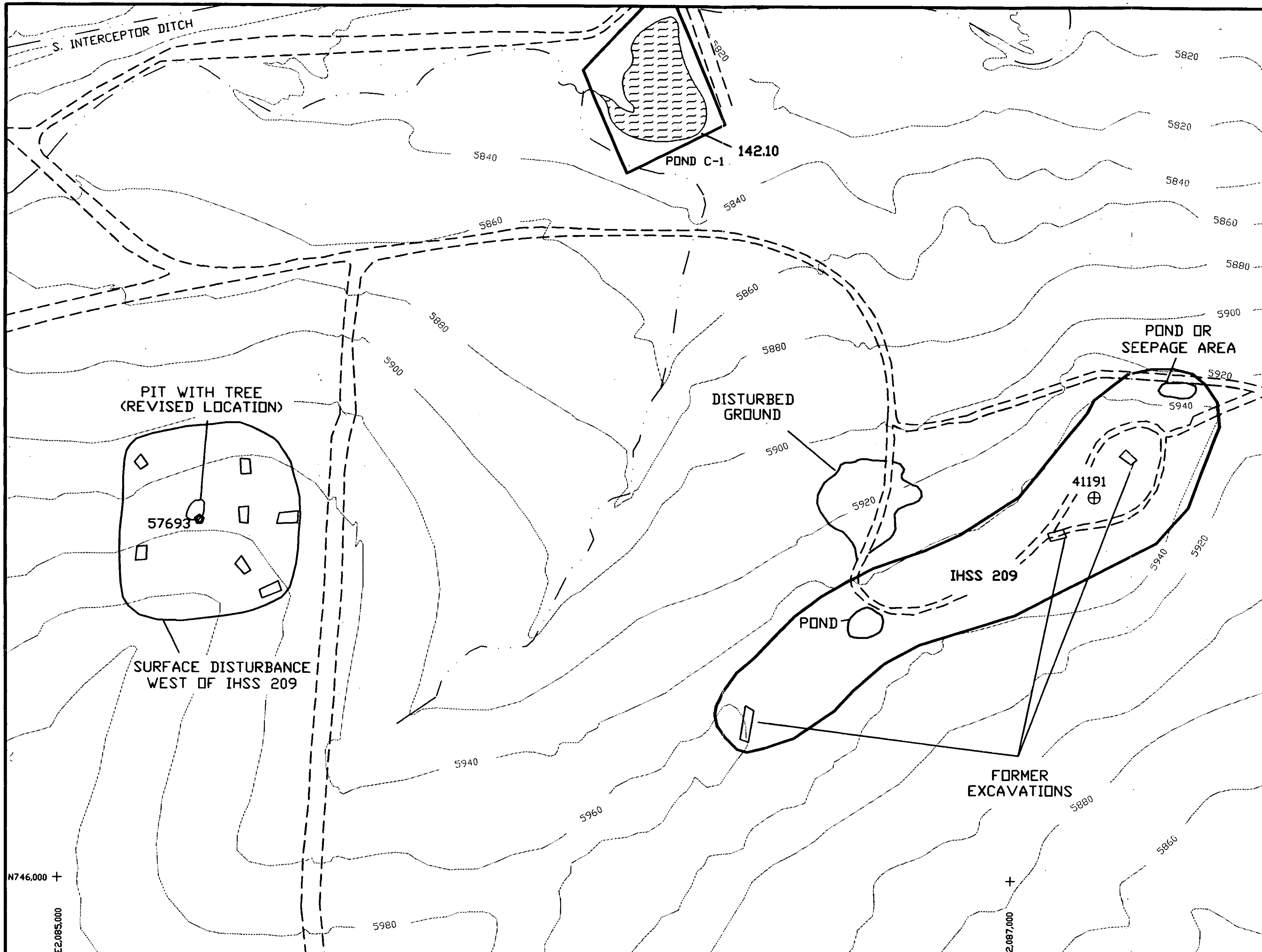
FIGURE 2.7.3.2-2B

2732-B.DWG



SURFACE SOIL SAMPLES WITH DETECTABLE SEMI-VOLATILE ORGANIC COMPOUNDS IHSS 209 AND SURFACE DISTURBANCE WEST OF IHSS 209

FIGURE 2.7.3.2-3



MAP LEGEND

STREAMS, DITCHES, DRAINAGE FEATURES

DIRT ROADS

SURFACE WATER IMPOUNDMENTS

REVISED PIT LOCATIONS

209 INDIVIDUAL HAZARDOUS SUBSTANCE SITES (IHSS)

41191 PREVIOUSLY EXISTING BOREHOLE LOCATION

57893 BOREHOLE LOCATION

N

0 100 200

SCALE: 1" = 200'

Drawn	N.M. 5/11/94	Date
Checked	[signature] 5/11/94	Date
Approved EG&G		Date
Approved DOE		Date

BOREHOLE LOCATIONS IHSS 209 AND SURFACE DISTURBANCE WEST OF IHSS 209

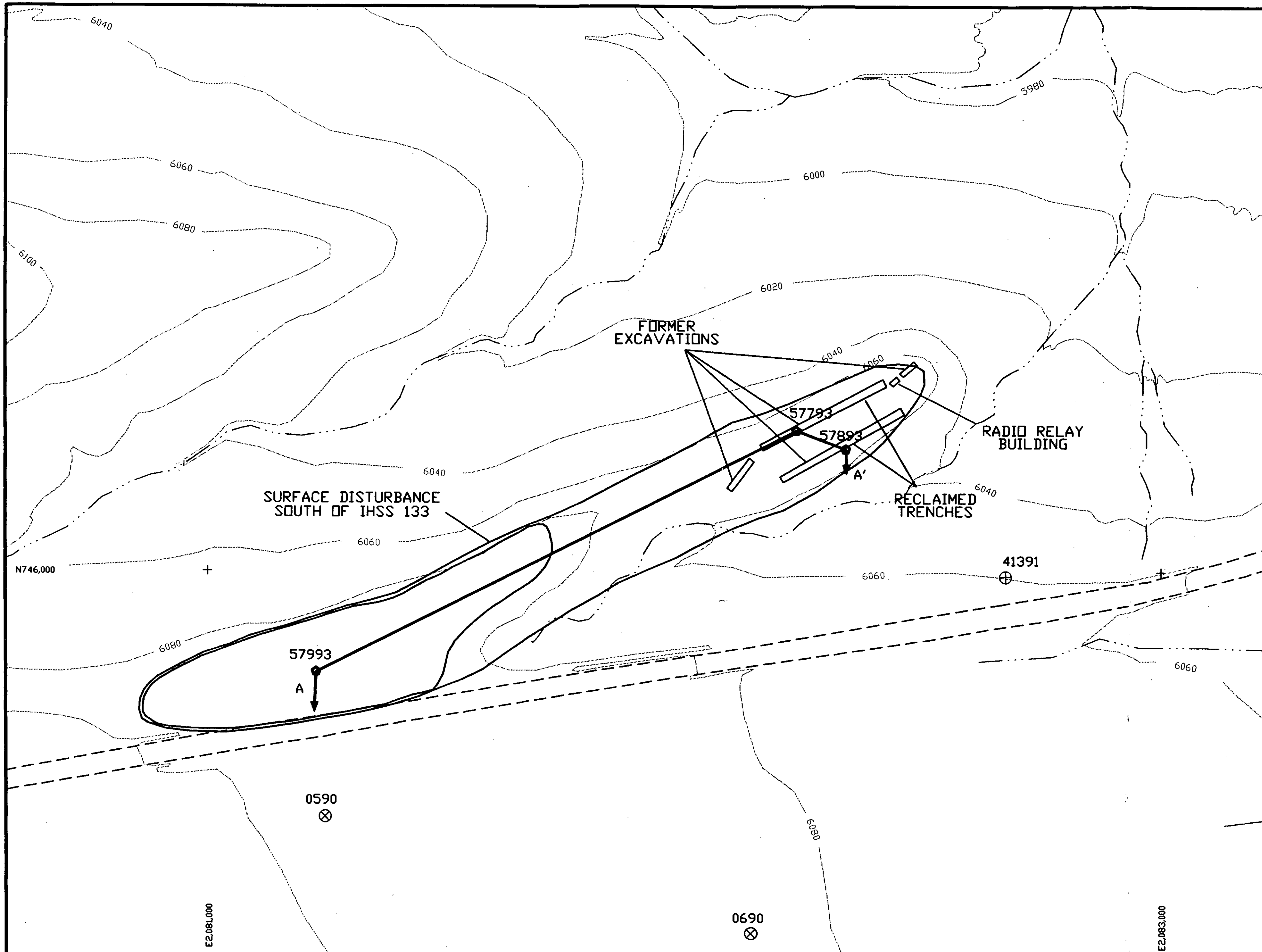
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.7.3.3-1

2733-1.DWG



MAP LEGEND

STREAMS, DITCHES, DRAINAGE FEATURES

DIRT ROADS

SURFACE WATER IMPOUNDMENTS

REVISED PIT LOCATIONS/ FORMER EXCAVATIONS

209 INDIVIDUAL HAZARDOUS SUBSTANCE SITES (IHSS)

41391 PREVIOUSLY EXISTING BOREHOLE LOCATION

0690 PREVIOUSLY EXISTING MONITORING WELL LOCATION

57893 BOREHOLE LOCATION

A A' CROSS SECTION LOCATION

-N-

0 100 200

SCALE: 1" = 200'

Drawn	N.M.	5/11/94 Date
Checked	[illegible]	5/11/94 Date
Approved EG&G		Date
Approved DOE		Date

BOREHOLE LOCATIONS SURFACE DISTURBANCE SOUTH OF ASH PITS

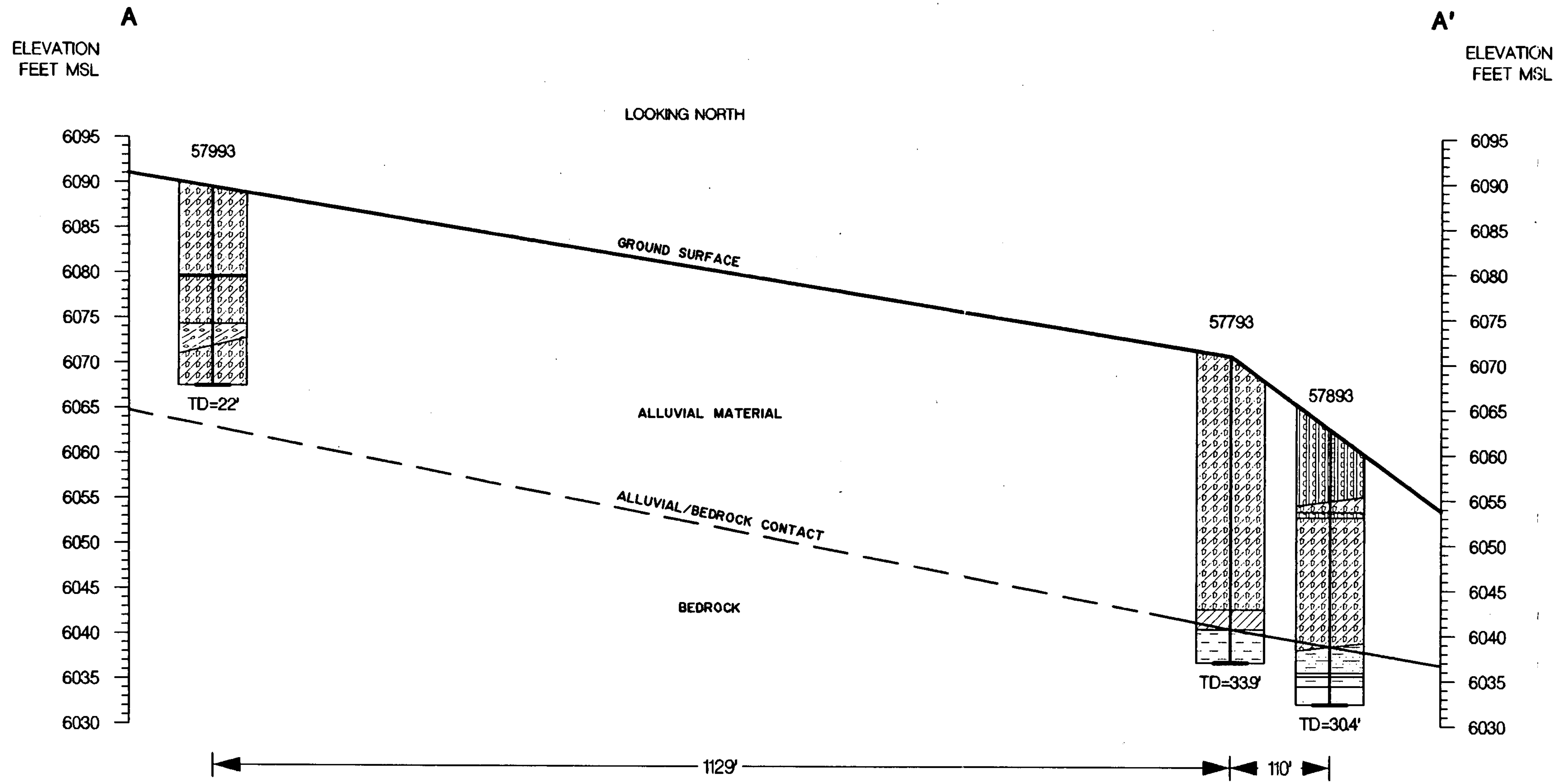
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.7.3.3-2

2733-2.DWG



LEGEND

57593 BOREHOLE IDENTIFICATION NUMBER

BEDROCK CONTACT-LINE DASHED WHERE INFERRED

NOTE: NO GROUNDWATER WAS ENCOUNTERED DURING DRILLING OF THESE BOREHOLES

SCALE

0 150

Feet 2 4 6 8 10

VERTICAL EXAGGERATION X 10

CLAYSTONE

GC CLAYEY GRAVEL

SC CLAYEY SANDS

SANDSTONE

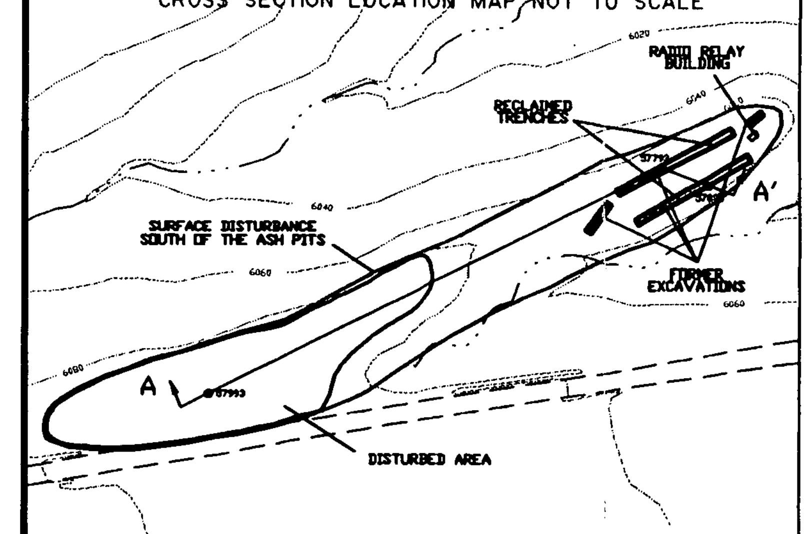
SW SAND

CL SANDY CLAY

CLAYEY SANDSTONE

SM SILTY SANDS

CROSS SECTION LOCATION MAP NOT TO SCALE



Drawn N.M. 5/13/94 Date

Checked 5/13/94 Date

Approved EG&G Date

Approved DOE Date

GENERALIZED GEOLOGIC CROSS SECTION A-A' SURFACE DISTURBANCE SOUTH OF THE ASH PITS

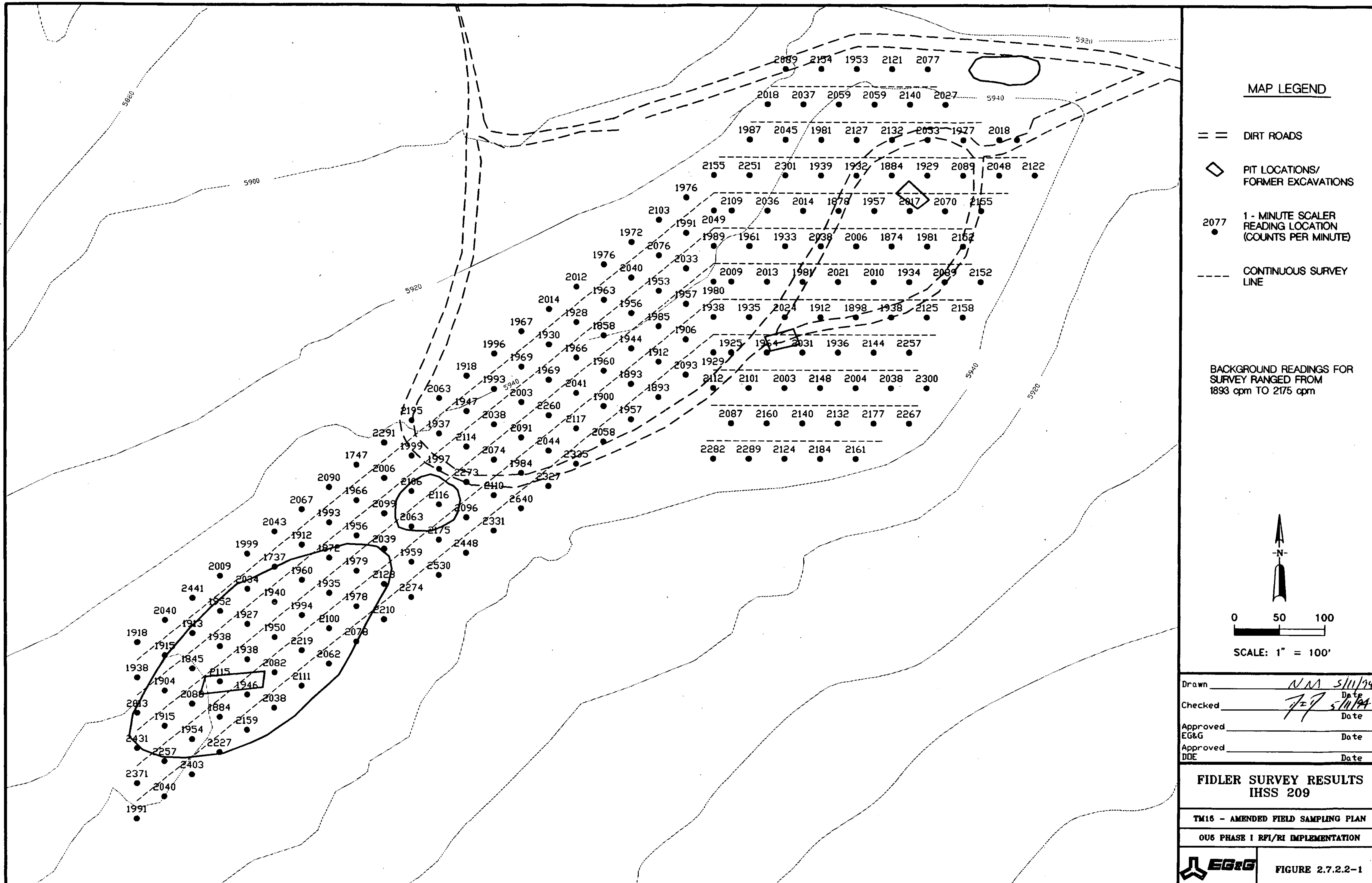
TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.7.3.3-3

2733-3DWG



Drawn	N M 5/11/94 Date
Checked	[illegible] 5/11/94 Date
Approved EG&G	Date
Approved DOE	Date

FIDLER SURVEY RESULTS IHSS 209

TM15 - AMENDED FIELD SAMPLING PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

FIGURE 2.7.2.2-1

2722-1.DWG